The FOUNDRY

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Castings Are Used in Drilling Oil Wells

RECENT headlines in the newspapers on the employment of the state militia in Oklahoma and Texas to stop oil production until the price reached $1 a barrel, again focused attention on the production problems of flowing gold, technically known as petroleum. To the general public drilling for oil is a romantic adventure which ends with success and riches. Unfortunately, realities show an entirely different picture. Due to the pressure of surrounding earth, underground water, etc. it is necessary to line the drilled hole with steel casing during drilling. That is accomplished by removing the drill after reaching a certain depth, and driving the casing down. However, before driving the casing, it usually is necessary to ream the hole to the proper size, and that is done with a tool known as a rotary underreamer which is shown in the accompanying illustration. It consists of a hardened steel mandrel carrying a series of eccentric cast manganese steel cutters and a fish tail or pilot bit at the lower end.

Courtesy E. B. Wiggins Oil Tool Co. Inc.
During Oil Well Drilling the Holes Are Reamed by the Underreamer Shown

Find Where Castings Can Be Sold

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Produces Engines for Automotive, Marine and Industrial

IN THE early days of internal combustion engine manufacture in this country, cylinder blocks were cast in dry-sand molds, as were any jobs that were the least bit intricate in design. Later, cylinder blocks were cast in molds formed completely of dry-sand cores. Then attention was turned to the possibility of using green sand molds. It was found that by skin-drying the surface sufficiently to present a comparatively dry mold face to the molten metal after the mold had been closed for a short period, excellent results were attained. Further experimenting led to the use of green sand molds without skin-drying and while perhaps the majority of cylinder blocks are made in that manner, many foundries still employ the skin-drying process.

Reference to internal combustion engines usually brings to mind the automotive industry, the largest consumer of that type of engine. However, the marine and industrial fields are large users of industrial combustion engines, particularly of the newer development, the compression-ignition or diesel engines, which use heavy oils for fuel, and fire by compression rather than with an electrical ignition system as exemplified by engines using gasoline as fuel. The aviation industry also is a rapidly growing consumer of internal combustion engines.

Due to the policy of many automobile manufacturers to concentrate as largely as possible the various manufacturing operations under one management, the majority of the cylinder blocks, crankcases, manifolds and other cast parts of automobile engines are made in foundries of the consumers. Even with such apparent concentration of manufacture, a large number of firms make a specialty of producing internal combustion engines for automotive use, and in addition supply them for other purposes. Others specialize in gasoline engines for marine use, and still others feature diesel engines for marine and industrial applications. The Buda Co., Harvey, Ill., is one of the important manufacturers of 4 and 6-cylinder gasoline engines for automotive, marine, railway and industrial uses, and 4 and 6-cylinder diesel engines for marine and industrial applications. Molds for gasoline engine castings are made on molding machines, and those for diesel engines are hand rammed due to their larger size.

Iron for various engine castings is melted in

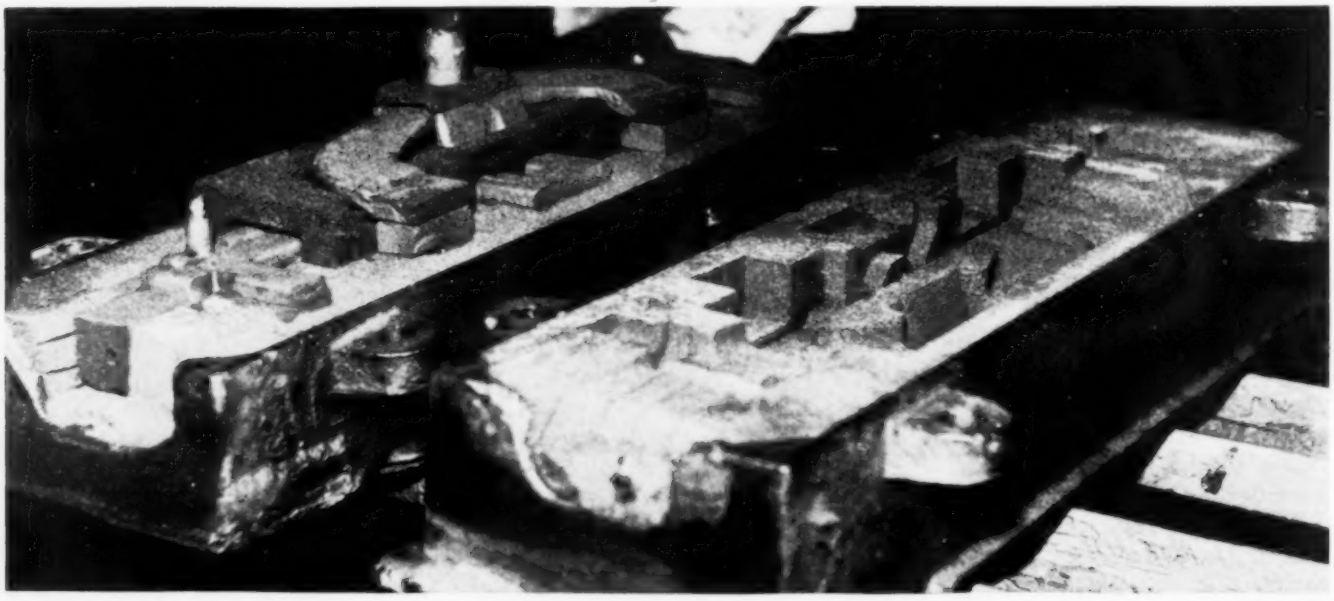


Fig. 1—Two Halves of a Dry Sand Mold Bonded with Linseed Oil. The Mold Is Clamped and Poured on End

By Edwin Bremer

Purposes

Fig. 3— Drag Half of a Mold for a 4-cylinder Motor with Cores in Place

one of two cupolas with 84-inch diameter shells which are used alternately. Cupolas are lined to 54 inches and melt about 50 tons during the afternoon's heats. Metal charges weigh 2000 pounds. A twelve per cent steel scrap addition is made to the iron for gears and cylinder heads, and the amount is increased to 20 per cent for cylinder blocks, which are cast en bloc, integral with the upper half of the crank case. One per cent nickel and 0.30 per cent chromium additions also are made for all castings through the use of a proprietary alloy containing those elements and iron.

Cores for various castings are made on the bench, and on hand and air-jolt type core machines supplied by the International Molding Machine Co., Chicago. Fig. 6 shows the manner in which cylinder barrel cores are made for light-6 and 4-cylinder engines. Those cores are made on a rollover, air-jolt machine, and are produced in halves on a center line through the length of the engine. The reference to the center line is made to distinguish the manufacture of those cores from that used in making cores for the large 6-cylinder engines.

In the latter, each barrel core is made in two halves, that is to say the center line is through each cylinder at right angles to a line through the row of cylinders. With the former method two cores form the barrels and the upper part of the crankcase while in the latter 12 cores are necessary for the same purpose. All cores are made from sand bonded with a linseed-oil base core oil and blended in a mixer supplied by the National Engineering Co., Chicago.

Cores are turned out on steel plates or into core drying boxes in the case of intricate or special shapes and transported to ovens on rack type cars. They are dried in five ovens which have doors at either end to facilitate loading and unloading. Racks loaded with green cores enter through the door facing the core room and after drying are removed through the door on the opposite end of the oven. The ovens were made by the Foundry Equipment Co., Cleveland, and are fired with butane gas which is a newcomer in the field of industrial heating. Butane gas also is used for skin drying the molds.

Butane is liquid at about 34 degrees Fahr., and as may be surmised is quite volatile; being converted into a vapor at slightly higher temperatures. It is a byproduct of natural gasoline and is shipped to the consumer in tank cars. One gallon of the liquid has a theoretical heat content of 102,400 B.t.u., and will produce 32 cubic feet of butane vapor which is mixed with air to form the combustible gas. Usually it is desired to form a combustible gas with 570 B.t.u. per cubic foot so 5.7 gallons of the liquid butane is

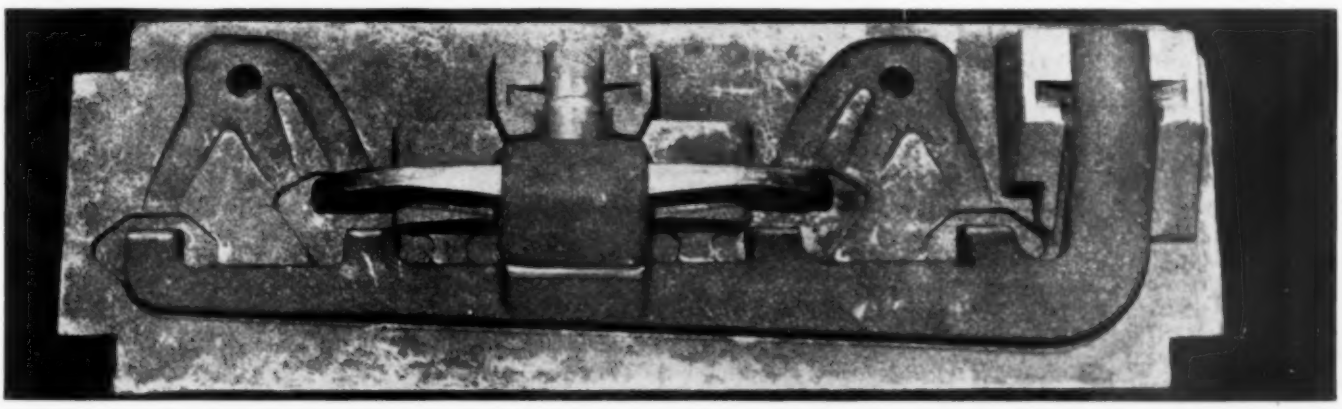


Fig. 2—Cores for a Hot Spot Manifold Are Hung from the Cope Which, in This Case, Also Is Made in the Form of a Core

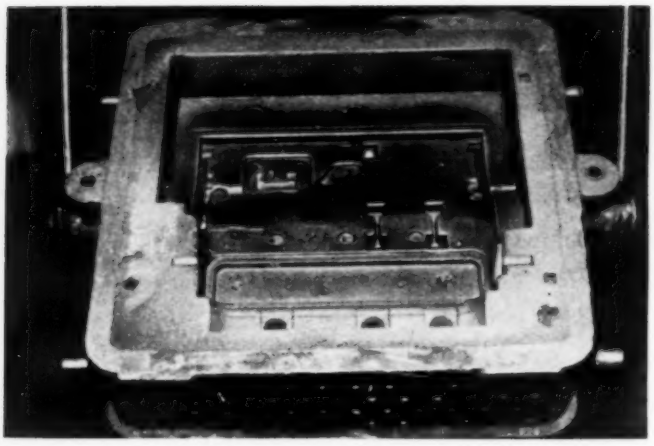


Fig. 4—The Cope for the Drag Shown in Fig. 3 Is Blacked and Carefully Skin Dried Before Closing

mixed with 817 cubic feet of air to produce 1000 cubic feet of butane gas.

In addition to producing cores, the core room also supplies some molds made completely of core sand, and dried similarly to cores. Two halves of one of the molds for a special water-cooled manifold for a marine engine are shown in Fig. 1 The complete mold is formed of 13 cores since the two halves of the mold proper may be considered as cores. Actual cores forming the hollow portions of the casting, shown assembled in the mold at the left, comprise 11 separate pieces.

The two mold halves are made on air-jolt molding machines, turned out on large flat plates and transported to the ovens for drying. After they are dried, the molds are returned to another portion of the core room where the 11 cores are set in position. Although the cores previously have been inspected for accuracy, the core setter, again examines them while assembling in the mold to see that the various parts fit together as nearly perfect as is practicable. Where necessary, the core setter files the core until it seats properly, and then applies a little core paste to the joints.

Poured on End

After the cores are assembled, the molds are transported to the foundry floor adjoining the core room. The two halves of the mold are clamped together, and are stood on end for receiving the molten metal. As may be observed from Fig. 1 a portion of the ends of the flasks is cut away to form an entrance for the metal, and the sand of the two molds also is cut away at that point to form a basin. The molten metal enters the casting cavity through 12 narrow gates in the form of slots. Eight gates are placed in half of the mold in which the cores are assembled, and they are spaced equally around the core print projecting into the basin. The remaining four gates are cut into the other half of the mold. When the two halves are assembled, the 12 gates approximately form a circle around the core print.

Figs. 2 and 5 are the cope and drag respectively for what is termed a hot-spot manifold in which cores play a large part, as the cope is formed completely of them. The main body of the cope is jolted on a molding machine, and dried in the oven. As may be observed from Fig. 2, it contains 2 sprue openings, each of which opens into three gates. While not apparent in the illustration, due to the cores already being in place, the body also contains a number of other openings into which the cores are fitted to hold them in place.

Core May Cut Walls

After the cope body is dried, it is returned to the core room for assembling the cores. That operation is similar to that previously described, except that only 6 cores are used instead of 11, as the hot-spot manifold is not as intricate as the water-cooled manifold. In the latter, three separate passages are involved, namely for water, fuel and exhaust gases, while in the hot-spot type only two passages for fuel and exhaust gases are needed. In either case, the cores must not get out of alignment as a slight shift in any direction will allow the core to cut through the thin walls between the passages.

The drag half of the mold for the hot-spot manifold, shown in Fig. 5, is rammed by hand. Two ramup cores which form the narrow space separating the exhaust gas chamber from the fuel chamber on either side of the hot-spot portion, are placed on the pattern before proceeding. Then the molder riddles on a layer of molding sand on the pattern, shovels in some backing sand, and rams it in place. The process of shoveling in backing sand and ramming is continued until the mold is filled. Excess sand is leveled off with the handle of the rammer, and some loose sand scattered over the top of the mold. The molder rubs a bottom board into place and clamps the pattern board, flask and bottom board together with four clamps, two on either side.

Roll the Mold Over

After that operation is finished, he obtains assistance from the molder on the adjoining floor to roll the mold over, and lift the pattern. The pattern is placed to one side, and the molder carefully inspects the mold surface to see that all the edges are clean and sharp. At such points where the sand is disturbed, it is pressed into place with the proper molder's tool.

As may be observed from Figs. 2 and 5, there is little likelihood of inserting the cope into the drag end for end, due to the tell-tales employed. Three of the corners of the cope are cut back approximately in the form of squares while the fourth corner is champfered at 45 degrees. The drag, of course, has its corners arranged in the reverse to those of the cope. Attention also is directed to the ample provisions made for carrying away the gases formed by the cores. These are in the form of wide *Vees* cut in the wall of the drag near the left end and at the center as shown in Fig. 5.

When the drag has been finished to the satisfaction of the molder, he places the cope. First, he sets a jig formed of wood on the drag flask. The jig contains side pieces or fing-

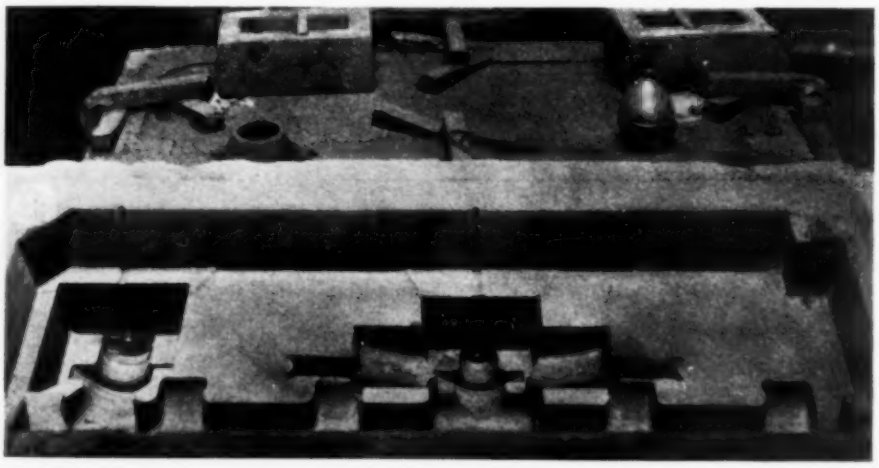


Fig. 5—A Green Sand Drag Is Used with the Cope Shown in Fig. 2

ers projecting downward, which fit over the sides of the flask, and prevent it from shifting in any direction. The opening in the jig is the same shape as the outside of the body core of the cope. The jig is supported a short distance above the drag, but guide pieces on the inside extend down to the top of the drag. That arrangement allows the cope to be seated accurately.

The molder attaches a carrier to the dry-sand cope. The carrier is a simple, but effective device which facilitates handling the cope, a bulky, unwieldy object at best. The carrier is constructed of wood, and consists of two long side pieces shaped into handles on the ends. The length of the side pieces is such that they extend over the ends of the flask sufficiently to be gripped by the men and lowered conveniently. The two side pieces are separated by end blocks to form a frame slightly narrower than the width of the cope. That frame is mounted on four legs about 12 inches long, and the ends of the legs are joined by four boards which form a rectangle. Two cross pieces in the upper frame about 6 inches from either end from the supports for two long hooks which are threaded at the upper ends passing through the cross pieces. Large wing nuts fit the threaded portion of the hooks.

In using the carrier, the wing nuts are backed off until the hooks extend below the underframe. The underframe then is placed over the cope, and the hooks are inserted in metal eyes placed in the top of the cope. The wing nuts are tightened until the flat surface of the cope rest firmly against the under frame. The molder with the assistance of the man from the adjoining floor lifts the cope over the jig, and lowers it carefully into place. The wing nuts then are backed off, the hooks removed from the eyes, and the carrier placed to one side until the next occasion for its use.

Clamp Up the Mold

The next operation is to clamp the mold. Since the cope is inserted in the drag instead of the usual position on top of the drag, clamping is not as easy as in the latter case. However, U-clamps made from heavy, square-section bar steel with long legs facilitate the clamping operation. The legs extend about 6 inches beyond the outer edges of the cope as may be seen in Fig. 5. Wedges driven first between the clamp and the top of the flask, and then between the cope and the clamp, hold the cope securely in position. Four clamps, one on each side are used.

After the mold is clamped, the molder places the pouring basins over the sprues, and a ring or collar over the riser. The pouring basins and riser ring are made in the core room from the regular core sand mixture, and dried in the ovens. The basins serve two purposes. One of course, is that of forming a reservoir for the molten metal and a means for directing the metal into the casting cavity. The other is a skimming device which has a double action. The first is that performed by causing the metal to flow under a partition dividing the basin into two parts, and the second takes place when the metal drops through the perforations in the bottom of that portion of the basin directly over the sprue opening.

While the molding methods described depict the practice employed in producing light and intricate castings which form a necessary part of every gasoline engine, the manufacture of cylinder blocks also requires careful attention to details. The cylinder block constitutes the largest part of the motor, but that apparent bulk is complicated by light and heavy sections, and intricate water passages for cooling purposes.

As indicated previously, several methods are available for making blocks, but the majority of those castings are produced either in straight green sand or in green sand molds which are skin-dried on the face. The latter method is the one followed in the foundry of the Buda company. Briefly, the copes and drags are made on separate molding machines, and transported a short distance where they are skin dried. After the drying operation, they are picked up and carried to the pouring floor where the cores are placed in the drag.

Molding machines are of the air-jolt, rollover type with pattern draw, and were supplied by the Osborn Mfg. Co., Cleveland. Figs. 3 and 4 show the drag and cope molds for a 4-cylinder block. Each machine has two operators and a finisher. The molds are transported by crane from the molding machines to an open space about 20 feet away and set down face up on two long wooden skids. The molds then are sprayed with blacking, and are skin dried with burners using butane gas. Six men make from 80 to 100 complete molds per day.

After the molds are dried to the correct state, the drags are picked up by a crane and transported to the pouring floors some distance away. Two core setters then proceed to set the cores. The first cores placed compose one-half the jacket core for the valve side of the motor. The next cores are the two end pieces at either side of the cavity. Then one-half of the cylinder barrel core is set in place.

Check Core Setting

The other half of the barrel core is placed on that in the drag, and the cores forming the other side of the water jacket core are set in position. Three chaplets are placed on the water jacket core, and the mold is ready to be closed. While the description of setting the cores may give the impression that the operation is conducted in a more or less haphazard fashion, the reverse is true. Due to the comparatively light sections of the outer water jacket wall, and that separating the water passage from the piston chamber, the cores must be placed with almost watchmaking accuracy.

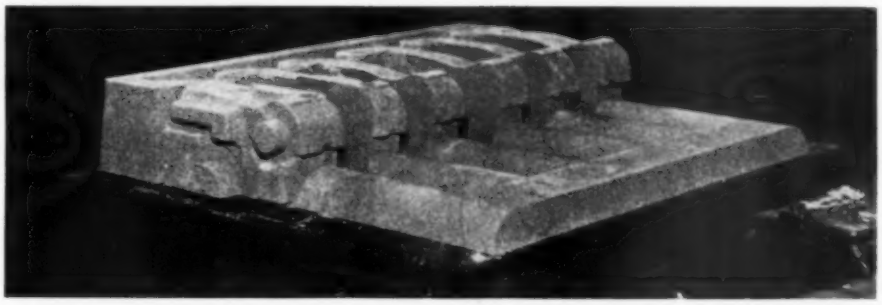


Fig. 6—One Half of a Cylinder Barrel Core for a 6-Cylinder Motor

To insure the greatest accuracy possible in placing cores, and to eliminate as much as possible of the *human element*, jigs with varying contours are employed. These are placed on the flask in some cases, and in others are over the core after it is placed by the core setters. In either case, the device used indicates whether the core position is within the tolerance allowed.

After the mold is closed, a runner basin of green sand is formed over the three sprues leading to the mold cavity. A wooden frame about 3 inches deep, 6 inches wide and 2 feet long is centered over the sprue holes. Then a tapered block a little smaller than the inside dimensions of the frame is centered within the frame. Sand is rammed carefully between the frame and block, and the block is removed, leaving a rectangular runner basin with slightly tapered sides. Three ring cores now are placed over the respective riser openings, and the mold is ready to be clamped, and poured.

This is the first of two articles describing methods employed in the foundry of the Buda Co., Harvey, Ill. The concluding article will appear in an early issue.—THE EDITORS.

Gray Iron Institute Builds on Local Extension Plan

INTENSIFYING the work and service of the organization through extending its activities on a basis of group development provided the keynote of the fourth annual meeting of the Gray Iron institute, held at West Baden Springs, Ind., Oct. 15 and 16. The report of Arthur J. Tuscany, manager noted an average of 1½ group meetings a week held during the year just closed. The plans of the officers and working committees center upon continuing the group cost study, and extending a similar plan to bring the work of the technical and merchandising units to the different communities where groups of members have been or will be established.

A. E. HAGEBOECK, new president of the Gray Iron institute, was educated in the University of Chicago, Chicago, and was graduated from the University of Iowa in 1907. or five years after graduation he had charge of boat and barge construction on the Mississippi river with the United States engineering corps. from 1912 to 1915 he had charge of the Birmingham plant of the F. J. Lewis Mfg. Co. In 1915 he purchased an interest in the Frank Foundry & Machine Co., Davenport, and spent a year at that plant. In 1916 the company built a second plant at Moline. At present Mr. Hageboeck is secretary-treasurer of the Frank Foundries Corp., Davenport, Iowa, and Moline, Ill. Mr. Hageboeck has been actively identified with various community interests in the Quad Cities.

The sessions opened with a luncheon meeting Thursday, at which President B. H. Johnson, Florence Pipe & Foundry Co., Florence, N. J. welcomed more than 80 delegates. At the business session following, Mr. Johnson sketched the accomplishments of the year, when the institute was operated within its budget and extended its operations.

W. J. Grede, Liberty Foundry, Inc., Wauwatosa, Wis., treasurer of the institute reported a satisfactory financial condition. Following Mr. Grede, Manager Tuscany outlined the scope of work which he emphasized as even more essential in times of stress than under normal business conditions. The technical department is establishing recommended practices. The merchandising committee has developed a sales manual capable of expansion by periodic bulletins. The latter committee also sponsored a trade practice agreement and secured its adoption by the National Association of Purchasing Agents. This code appeared in THE FOUNDRY, Sept. 1, 1931. The cost work also has been extended in a manner which later was reviewed in detail.

Receive Committee Reports

The following committee reports were received and approved: Finance and budget, presented by H. S. Chafee, chairman, Builders Iron Foundry, Providence, R. I.; membership, by H. P. Hubbell, Semi-Steel Casting Co., St. Louis; trade information, by C. B. Magrath, Greenlee Foundry Co., Chicago. The membership numbers 236 foundries, the same as one year ago. New enrollments have balanced those few firms which have withdrawn or have retired from business.

John L. Carter, Sacks-Barlow Foundries, Inc., Newark, N. J., chairman of the cost committee presided at the cost session which followed. The cost activity was started in April, 1929, and a standard cost system, the first objective, was published in January, 1930. It has been well received and adopted by both member and nonmember foundries. Charles A. Klaus, Newark, in the east and C. E. Mitchell, Cleveland, in the west have supervised the installation of this system in member foundries and in addition have been active in organizing groups for cost and management control work. These groups are now active in 16 cities, where meetings are held and comparative cost reports are presented and discussed to clarify the various points.

With W. J. Grede leading, an interesting round table on rate setting followed. With the method of establishing molding costs as the backbone of all cost study, Mr. Grede emphasized the need for arriving at some scientific base for determining this rate. Questionnaires were sent to the entire membership of the American Foundrymen's association to provide data on the present methods followed. In the greater number of cases, it was established that the superintendent establishes the base rate, usually by estimates in advance, with many using only individual judgment, although the majority depend upon a knowledge of earlier similar jobs. The basis for determining the rate vary from the sand volume, sand weight, or size of flask,

JOHN L. CARTER, vice president and general manager, Sacks-Barlow Foundries Inc., Newark, N. J., has been general manager of Barlow Foundry Inc. for the past 12 years. He has devoted a great deal of attention to the subject of foundry costs and in several instances has assisted individuals and groups in the compilation and adoption of suitable and adequate systems. His company was one of the first to join the Gray Iron institute and he was one of the original group of foundrymen engaged in the organization. Mr. Carter is a mechanical engineer, graduate of Stevens Institute of Technology, Hoboken, N. J., and Princeton university, Princeton, N. J. He has been president of the Newark, N. J., foundrymen's association for the past six years.

to consideration of cores, gaggers, types of pattern or mere differentiation between crane or hand handled jobs. Only 35 per cent of those responding had a definite system for estimating the rate on molding. A difference in judgment is the big factor in differing estimates, according to Mr. Grede. He mentioned the work of L. M. Sherwin, Brown & Sharpe Mfg. Co., Providence and commented upon the point system described in a paper by W. J. MacNeill, Federal Malleable Co., Milwaukee. The latter paper is presented on page 59 of this issue of THE FOUNDRY.

Budget to Small Output

R. O. Flanders, Blue Valley Foundry Co., Kansas City, Mo. presented an interesting paper on a system of budgeting all items of cost against an estimated production. He developed an interesting case, using actual figures to show the influence of rate of operation upon profits and the need for adjusting cost items to meet the present decreased business.

Charles A. Klaus, eastern cost consultant closed the session with a report of actual saving due to the work of local cost groups.

An informal dinner session, Thursday evening, was devoted to an experience meeting. A. E. Hageboeck, Frank Foundries Corp., Moline, Ill., stressed the importance of executives giving attention to the information and services of the institute. C. E. Mitchell, cost advisor, Oliver Smalley, technical director, Manager Tuscany, A. W. Lemme, Elizabeth Street Foundry Co., Chicago and John L. Carter, Newark, stressed the many angles of the central topic of how the individual member best may profit from the various activities of the institute through local groups.

The Friday morning session under chairmanship of President Johnson was devoted to considerations of the technical work of the institute. H. B. Hanley, American Laundry Machinery Co., Rochester, N. Y., chairman of the technical committee, presented a report covering the nine months' period since the establishment of this committee. The program adopted has been comprehensive and covers investigations, surveys, the promotion of standard practices and shaping the industrial applications of gray cast iron to the needs of industry.

Studies Test Bars

Since the first of the present year, the technical department has completed a survey of a series of test bars collected from 48 member foundries. Subsequent reports have detailed the findings of this investigation. A technical bulletin has been established for the information of members. Standard practices have been suggested and studies are being made on cupola practice, metal mixtures, molding, specifications and design engineering. In addition, the technical department has given professional service to member companies to assist in solving manufacturing problems. Public addresses in the interest of disseminating information on gray iron have been an additional feature of the technical department's service. Co-operative research projects are contemplated and eventually the institute expects to establish a central laboratory.

Enlarging upon the details of this technical program, Oliver Smalley, technical director of the institute, presented details covered in brief in the report of Mr. Hanley. A proposed specification which is being considered by the committe will suggest changes in methods of tests in line with a research on the influence of size of test bar upon the strength shown. A machined test bar never has more than 50 to 60 per cent of the area of the original bar from which it is cast. Mass is important.

J. H. Bruce
Elected Vice President of the Institute

Machined 1, 2, 3 and 4-inch bars from identical metal and similar test castings showed a drop in tensile with a decrease in proportional area of the machined section. Therefore, a range of test bars intended to develop a closer relationship between the proportional area of the bar as cast and as machined, probably will be suggested. A range in physical properties and classification of gray iron into four main divisions, each suitable for a definite range of uses, also is considered.

The general work of the committee has been to establish the relative properties of gray iron, to elevate the standards of manufacture, to standardize relative to design, to advance the technique of castings manufacture and finally to give foundrymen something definite to merchandise.

Mr. Smalley presented a suggested form for standard cupola charging sheets and suggested a rigid check upon analysis of materials to see that they conform with the analyses supplied by manufacturers. He also offered a new list of compositions and mixtures of gray cast iron for a wide range of uses. This list was offered merely as a guide and does not include alloy irons. Mr. Smalley affirmed that an analysis is worthless as establishing the character of a product. Sound castings are the result of technique, supervision and hard work, and the compositions given merely summarize common practice and are not absolute.

Competition Is Intensified

An inspirational address on increasing markets was presented by George L. Wilman, sales counsellor, Chicago. Mr. Wilman deprecated price considerations as the basis for sales and presented constructive ideas for bettering foundry sales practices. Mr. Wilman stated that virgin markets are gone, that we have completed the era of construction and have entered upon a period of refinement. This very fact brings a consolidated and intensified competition. The day of the small firm operating individually is past and co-operative effort such as is typified in trade associations is vital to business success.

In commenting upon Mr. Wilman's address, Manager Tuscany emphasized many of the points developed. He stated that it is impossible to increase business at the expense of competitors and particularly through price cutting. He recommended the principle of firm bidding presented to the steel castings branch of the foundry industry at a meeting of the Steel Founders' Society in Chicago, which was reported in THE FOUNDRY for Oct. 1.

J. H. Bruce, chairman of the merchandising committee, related the work which has been done by the central office of the institute in compiling a sales manual to which additional bulletins are added.

Customer Responsible for Insurance

A question has been raised as to the observance of that portion of the Gray Iron institute standard sales practice code, referring to responsibility for patterns. According to a poll of the members, no foundry represented at the meeting carries insurance on customers' patterns, but holds that this responsibility is incumbent upon the customer.

At the luncheon meeting William J. Barrett, the President's organization on unemployment relief, Washington, spoke in behalf of the Gifford committee and urged mobilization in support of unemployment relief plans.

(*Concluded on Page* 69)

To Intensify Safety Practices In the Foundry Industry

MORE intensive application of safety practices in the foundry industry was planned at sessions of the twentieth annual Safety congress and exposition at the Stevens hotel, Chicago, Oct. 12 to 16. The congress was divided into 130 sectionalized sessions, including metals, aeronautical, advanced safety engineering section of American Society of Safety Engineers, automotive and machine shop, chemical, construction, industrial health, power press, steam and electric railroad sections and many others. It was pointed out by C. W. Bergquist, president of the National Safety council, which sponsored the congress, that the widespread economic depression of the last year has been a challenge to the safety movement. He declared that to pause now would be to compromise on the progress that has been made previously.

The 1931 average frequency rate in the metals section was shown to be 11.117, representing a 28.6 per cent decrease from the 1930 rate of 15.604, and a 25 per cent decrease from the 1929 rate of 14.813. In outlining the metals sections statistics for 1930, T. A. Schendel, safety director, Caterpillar Tractor Co., Peoria, Ill., pointed out that the steel industry had an accident frequency rate of 11.99, which placed it in fifth place among about 26 major industries. It is pointed out also that the accident frequency rate for the metals industries in the last three years was 35 per cent below the average for all industries, but the accident severity rate was 25 per cent higher than for all groups. The foundry industry's frequency rate is about 30. This high figure is attributed in part to the more general necessity of foundry employes to adjust themselves to different jobs because of the inevitable versatility required in foundry operations of today.

Award Safety Trophies

Winners of the National Safety council safety contest trophies and certificates for 1931 were announced. In the so-called group A of iron foundries, first place was awarded to the Ohio Brass Co., Mansfield, O., with a record of 773,545 man-hours worked, with no lost-time accidents. Other winners in this group were Wilson Foundry & Machine Co., Pontiac, Mich., 1,285,676 hours worked, 11 lost-time accidents with a frequency rate of 8.556; and American Radiator Co., Elmwood avenue group, Buffalo, N. Y., 619,325 hours worked, seven lost-time accidents with a frequency rate of 11.303.

In group B of the iron foundries, first place was won by National Radiator Corp., Johnstown Union plant, Johnstown, Pa., 110,294 man-hours worked, and no lost-time accidents. Other winners were Universal Foundry Co., Oshkosh, Wis.; Continental Roll & Steel Foundry Co., Wheeling Mold & Foundry division, Warwood plant, Wheeling, W. Va.; Chattanooga Implement & Mfg. Co., Chattanooga, Tenn.; and Louisville Car Wheel & Railway Supply Co., Louisville, Ky.

No Lost-time Accidents

First place winner in the steel foundries group was Kensington Stel Co., Chicago, with 88,462 man-hours worked, and no lost-time accidents. Other winners were Industrial Steel Casting Co., Toledo, O.; and the American Rolling Mill Co., Central works, Middletown, O. In group A of the heavy machine shops, General Electric Co., Philadelphia works, was first, with 3,077,666 hours, and six lost-time accidents, with a frequency rate of 1.950. In group B of the heavy machine shops classification, first place was won by Whiting Corp., Harvey, Ill., with 435,835 man-hours worked, and no lost-time accidents.

F. A. Lauerman, Interstate works of Republic Steel Corp., was elected general chairman of the metals section, succeeding H. G. Hensel, western division of the Youngstown Sheet & Tube Co. Other metals section officers include Harry Darr, Bethlehem Steel Corp., Johnstown, Pa., secretary; A. V. Berquist, Youngstown Sheet & Tube Co., East Chicago, Ind. chairman of the publicity committee; J. K. Stafford, Mississippi Valley Structural Steel Co., Decatur, Ill., chairman, membership committee; H. M. Crogham, Inland Steel Co., East Chicago, Ind., chairman, poster committee; and F. G. Bennett, Buckeye Steel Castings Co., Columbus, O., chairman, foundry research committee.

One session of the metals section meetings was devoted exclusively to foundry problems. Dr. Leonard Greenburg, of the United States Public health service, Yale medical school, New Haven, Conn., gave an outline of the scientific survey, covering several years, of the steering committee sponsored by the National Safety council, relating to hazards in sandblasting and in foundry cleaning departments. The study centered in atmospheric pollution as affecting workmen exposed to inhalation of dust, and covered approximately 28 per cent sandblast rooms, 44 per cent barrel type sandblast equipment, 21 per cent cabinets, and 9 per cent sandblast tables.

John A. Oartel, chief of the safety bureau, Carnegie Steel Co., Pittsburgh, presented numerous pictures showing common foundry accidents resulting from faulty loading of castings on cars, antiquated equipment, congested cleaning departments, poor foundry *housekeeping*, exposed rail ends on cleaning floors and lack of guarding equipment. G. E. Sanford, General Electric Co., Schenectady, N. Y., gave an illustrated talk on a completely conveyorized and continuous pouring system of one of his company's gray iron foundries, in which the speed of the conveyor system is regulated chiefly by the thickness of the walls of castings and the time required for passage through cooling tunnels. Through this conveyor system, he pointed out, on which 600 flasks an hour are handled, accidents are much reduced because of modernized equipment.

The foundry round-table discussion on safety problems was led by F. G. Bennett, Buckeye Steel Castings Co., Columbus, O., chairman of the foundry committee. This discussion emphasized the importance of modernized equipment in reduced foundry accidents. Mr. Bennett emphasized the importance of further intensive study in accident prevention to reduce the accident frequency rate in foundries.

Receives Appointment

L. V. Murray, district manager of the industrial department, east central district, of the General Electric Company with headquarters at Cleveland has been appointed manager of the Graybar-Western Electric department with headquarters at Schenectady. J. P. Jones, manager of the machinery manufacturers' section of the industrial department, Schenectady, succeeds Mr. Murray at Cleveland, and J. J. Huether succeeds Mr. Jones as manager of the machinery manufacturers' section.

Prevent Losses With Proper Gates and Risers

By Pat Dwyer

TIMID foundrymen who go to so much trouble to break the *fall* of the iron by a series of jogs or steps in a sprue leading from the top to the bottom of a high mold, would gain an entirely new conception of the action of flowing metal, if they were to study the gating and pouring methods employed in foundries where long cast iron pipes are produced.

According to the theory of the timid ones, the iron must be introduced into the mold slowly and gently at the bottom. If introduced in any other manner, particularly if it is poured in at the top, these foundrymen are convinced, it will tear all the sand from the walls of the mold. This is just another one of these instances in which investigation has ceased before the full truth was established. The top gate has been blamed for a condition due either to the sand in the mold or the manner in which the sand has been manipulated. In some instances top gates have been condemned without a trial, simply because the foundryman labored under the delusion that flowing iron and flowing water affect sand in the same manner.

Molten Iron Develops Skin

To a slight extent the action of the two liquids is comparable, but a fundamental difference lies in the fact that molten iron commences to develop a skin the instant it comes in contact with the face of the mold, while water sinks among the grains of sand. Manifestly a liquid that develops a sheath or skin will not disturb the sand face to anything like the same extent as a liquid which penetrates among the grains and dissolves the sand. In the majority of instances where top gates have proved disastrous, an impartial investigation conducted far enough, would show that the defect was due to one of two causes, erosion or explosion. Lack of bond in the sand caused it to wash in front of the iron stream, or, steam generated by the heat of the iron lifted some sand from the face of the mold.

The fact that a coarse grade of sand, properly rammed and properly dried will resist all the so-called cutting action of metal poured through the top of the mold, is attested by the successful production in this country annually of over 1,500,000 tons of cast iron pipe, molded, dried and cast in a vertical position. This represents approximately 13 per cent of the normal gray iron casting production and would seem to indicate that top gates have a legitimate place in the foundry and should not be condemned carelessly or off hand without a free and impartial trial.

Serves as Example

CAST iron pipe, constituting approximately 13 *per cent of all the gray iron poured into castings in the United States, serves as a shining example of the efficacy of top gates and a proof that this type of gate is the most satisfactory when used under proper conditions. Without proper investigation, a top gate frequently is blamed for defective castings that in reality result from one or more of many other factors, including unsuitable sand, or sand that has not been properly prepared and applied. Advent of mechanical equipment in stove and heater foundries has led to the development and adoption of gating systems that differ radically from those of former days when man power was used more freely in handling and distributing the metal. A single sprue and a bull ladle suspended from a monorail, take the places of multiple sprues and a gang of men with ladles pouring metal four-up.*

Two methods, shown at the right and left of Fig. 107 are employed for forming the runner basin on top of a pipe mold. At the right the runner basin is formed in the top of the pipe flask. A flat ring core *C* is placed in a tapered seat at the bottom of the basin. This ring core clips the main core closely and automatically centers it in the mold. The ring core is pierced with a number of small rectangular openings or gates *G* through which the iron enters the mold. The number of openings and their size depend on the size of the pipe and the volume of iron to be poured through them. The basic idea is to conduct a maximum volume of iron into the mold in a minimum period of time, also to introduce the iron in a great number of small streams, to minimize the erosion effect, rather than in one or two large streams.

Use Alternative Methods

A slight variation to the foregoing method is shown at the left where the ring core *C* fits in a slight depression in the top of the mold. A cast iron ring *R* lined with loam is placed on top of the pipe flask. The loam lining projects over the ring core and helps to hold it in place.

In a third method, employed principally on small pipes, the ring core is made with a vertical back wall and the combination serves as a pouring basin and gate. Immediately after the iron in the basin has solidified, it is broken with a sharp pointed steel bar or with the hook of the crane.

Pipe molds are not dried in an oven with a consequent waste of heat required to raise the temperature of the flask as well as the sand. All the heat is cencentrated on the sand lining which is dried from the inside toward the flask, instead of in the opposite manner where the heat first has to penetrate the flask walls. Each green mold is placed over an opening in an iron plate through which heat from a gas jet ascends and dries the sand in the mold. The relatively thin coating of sand dries in a few hours.

Stools on which the pipe molds are supported before and during the casting process are fitted with lugs on the outside to guide the flask and with a print on the inside to receive and center the short socket section of the core. This core is built around an iron ring which serves as a guide and a seat for the main core when it is lowered into place.

The socket core is set first, next the flask is lowered into place and then the long, main core is lowered

into place. Necessity of providing adequate head room under the crane is one of the reasons for molding and casting long pipes in a pit. Other reasons of course include the ease with which the flasks may be filled with sand from the floor level, and later, the ease with which the molds are filled with molten iron. For the ordinary 12-foot pipe lengths, the pit is 10 feet deep so that the top of the pouring basin is approximately 3 feet above the floor level. This distance ordinarily is sufficient to clear the ladle and bring the lip close to the edge of the pouring basin.

While the pipe still is red the crane is attached to the top spindle of the arbor by a suitable clevis. The arbor is extracted vertically and then placed horizontally on the floor in a convenient position for the men who later will place it in a spinning device and cover it with a coating of loam.

The hinged flask is lifted and placed horizontally on the floor where the clamps are removed from one side. The flask is opened as one might open a clam shell and the casting rolls out on a pair of parallel skid rails mounted on foundations about 6 feet apart. Here the pipe cools uniformly and remains straight.

Many other castings, including shells for paper mills are poured through top gates arranged in a circle. The gates are fed from a circular runner basin incorporated in the cope and dried with it. The size and number of gates vary according to the size and weight of the casting. Where six gates ½ x 1-inch might suffice on a shell 12 inches in diameter, four times that number ¾ x 2 inches are placed on a 4-foot diameter casting. Every effort is made to maintain a nice balance between a set of gates that will fill the mold rapidly and one that will not drain the basin faster that it can be filled from the ladle tipped at ordinary pouring speed.

Hydrants and other special pipe shapes are molded and cast horizontally and are gated according to a number of methods depending on local conditions. The method pursued in gating hydrant castings in a prominent eastern foundry is fairly typical.

Pour Hydrant Castings

The casting is poured from one end through several shallow branches located on the core print as shown in Fig. 108. The edge of the print does not fit closely around the core and as a result the fin encircling the core serves as an auxiliary gate. An upright gate pin is rammed in the cope on each side of the core print. The lower end rests on the projecting end of the set gate and the upper end terminates in a pouring basin. The gate pins are pulled out before the cope is lifted and no attempt is made to slick a foundation for the pouring basin.

Before the cope is placed on the drag the gate pins are returned and the surface of the sand in their vicinity is slicked smooth to form a bottom for the pouring basin. To prevent the iron from coming into contact with the flask bars, a light wood frame 10 inches wide inside, about 15 inches long and 1-inch deep is placed around the gate pins. It is filled with sand which is pressed down firmly and then scraped off flush and slicked. The runner box is placed on this prepared surface, the gate openings are covered with a suitable block and the space between the sides of the box and the block are rammed full of sand. The block then is removed, leaving a clean smooth, firm basin into which to pour the iron.

Foundrymen confronted with miss-run castings, particularly small castings on the outside of a *card* or *gate*, sometimes contemplate and sometimes actually carry out the practice of elevating one side or one end of the mold. The practice of pouring molds while in an inclined position is common in brass foundries devoted to the manufacture of light castings.

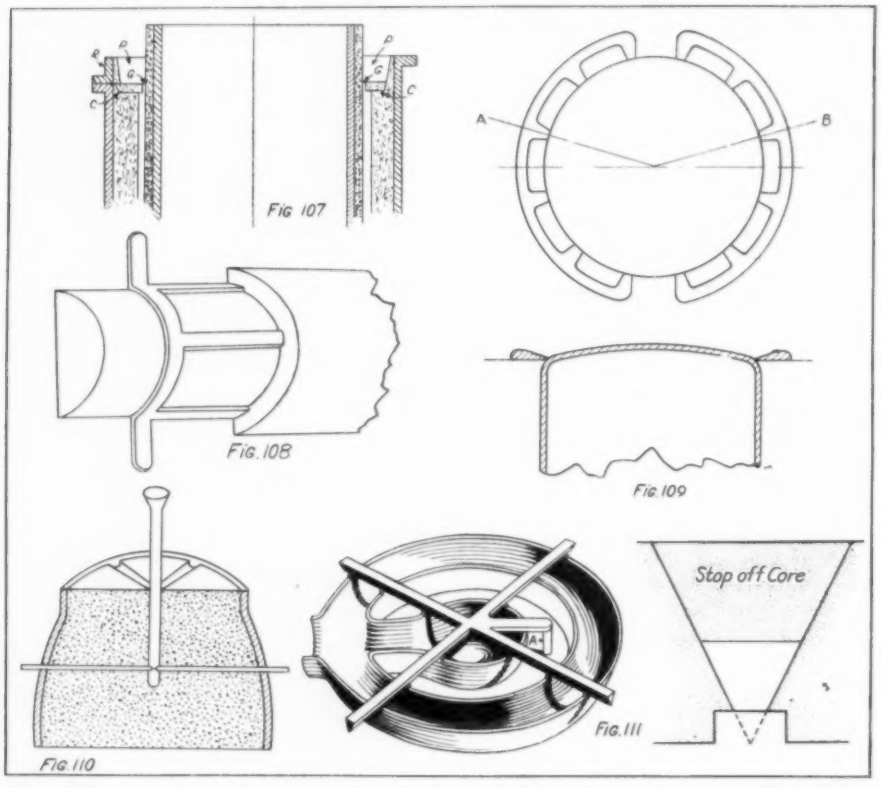


Fig. 107—Sectional View of Pipe Runner Showing Two Styles of Cover Cores. Fig. 108—Set Gate on Pipe Designed To Be Poured from End Horizontally. Fig. 109—Top and Sectional Views of Ring Gates on Pot. Fig. 110—Auxiliary Gates on Fire Pot Mold. Fig. 111 (Left)—Perspective View of Special Bottom Gate for Raidator Casting (Right)—Enlarged Sectional View Showing Detail and Application

Blame the Metal

This is due partly to the fact that the metal runs more readily, but principally to the fact that the molds are stacked and therefore in a more convenient position for pouring when set up on an incline. Iron of a suitable analysis for small casting, iron melted and poured at a high temperature, is more fluid than brass and should require no manipulation of the mold to make it run any reasonable distance.

In many cases a great deal of experimental and costly work is wasted on gates, their size, shape and position, when attention properly should be directed to the cupola with a view of securing iron of the proper temperature and fluidity to fill the molds readily.

Small and medium size pots in hollow ware foundries are gated in the manner shown in Fig. 109. After the drag has been rolled over and the follow board removed, two semicircular set gates are placed in position on the joint. The gates are flat on the joint side and convex on the upper or cope side. They are generously proportioned, but the edge which comes in contact with the rounded edge of the pot pattern is extremely thin and consequently breaks off quite readily after the casting has been poured.

Where the bottom of the pot is flat, a wedge gate usually is employed. Pop gates in wide variety are employed on pots up to 4 feet in diameter, where the pots are cast bottom up. Large pots usually are cast bot-

tom down and are gated in many ways. In one method widely practiced large pots are poured through a few pop gates located on the upper rim. Slag pots and other castings of a similar character weighing from 5 to 20 tons usually are gated on top. The iron from a circular runner basin enters the mold through a number of comparatively small pop gates spaced from 12 to 18 inches apart. The molds are either dry sand or loam.

Method adopted in one stove foundry for gating a firepot is shown in Fig. 110. At first the runner did not extend beyond the cope parting line where three branches conducted the iron into the upper edge of the casting. The falling metal caused the sand on the shoulder to cut and scab. Possibly a different grade of sand might have withstood the stream satisfactorily, but the foundryman naturally followed the line of least resistance. The sand caused no trouble on any of his other castings, therefore, he argued why should he tinker with a special brand to mold the firepots.

Cured the Trouble

He introduced a couple of auxiliary gates a few inches above the bottom of the pattern and has had no scabbed castings since. The vertical runner extends almost to the bottom of the sand on the inside of the pot. The pattern is pierced with two ⅜-inch holes almost diametrically opposite each other and 4 inches above the bottom edge of the pattern. Two ¼-inch rods are placed in these holes before the inside of the pattern is filled with sand. The inner end of each rod is pointed and rests in a pocket in the upright runner stick. The outer end projects 3 inches from the pattern. The rods are removed after the drag has been rolled over.

The small openings left by these rods conduct a quantity of metal into the mold before the remainder pours in through the branch gates at the upper joint. The light gates readily are broken out of the casting after the mold is shaken out.

Introduction of mechanical molding equipment into the stove and heater shops in many instances has resulted in the development and adoption of new gating methods. A half radiator for a hot air furnace is presented as a typical example of how this feature has been brought into line with a general policy of simplification and economy.

Formerly, these castings were poured four or five-up. Four or five runners with numerous branch gates formed an almost complete ring around the outer rim and four or five men poured iron simultaneously from hand ladles into these runners. A considerable amount of iron was required to fill all these gates and runners. Employment of four men as pourers was not practicable under the new system where the molds move on a long, continuous conveyor.

An ingenious type runner developed specifically for one of these installations is shown in Fig. 111 with a perspective view of the runner in position at the left and a sectional view, on an enlarged scale, of a branch of the runner at one of the contact points with the radiator pattern at the right. The sprue or upright member, extending to the joint of the mold is shown at *A*. A second sprue in the cope, not shown, forms a continuation of the passage. In this instance the half casting is molded open side down. The body of green

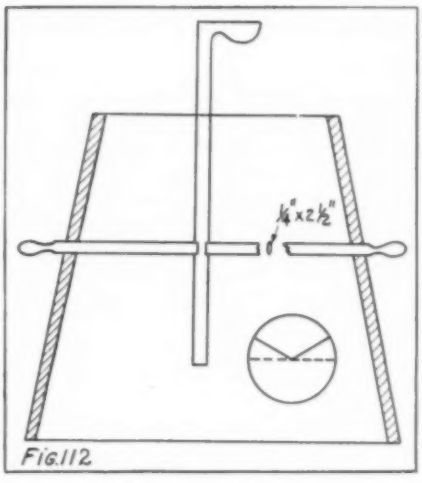


Fig. 112—As Shown in the Insert, the Gates Are Not Located Diametrically Opposite Each Other

sand forming the inside of the casting remains on the drag. In the finished mold all the gates are under the casting and the metal flows upward.

Poured From One Ladle

The iron from a single bull ladle is poured into one sprue in the center of the cope. The four runners at the bottom in the shape of a large *X* are designed to distribute the metal as rapidly at the bottom as it was distributed formerly from four points at the top.

The *X*-shaped runner, triangular in cross section, is provided with three transverse slots on the under side of each of the four branches. These slots rest on corresponding projections 3/16 x 1-inch on the radiator pattern. After the drag has been rammed full of sand, it is struck off flush and the runner pattern is extracted. V-shaped cores are dropped into the cavities as shown to the right in Fig. 111. These cores fill the cavity only part way. The open space constitutes the passage for the iron. The cores are slightly larger than the cavity and as a result they fit tightly and prevent any iron from leaking through to the bottom plate.

A simpler type of gate is used on the ash pan casting. A sectional view of gate and pattern with all extraneous features removed for clarity, is shown in Fig. 112. A 2-inch diameter upright sprue is fixed approximately in the center of the pattern and forms a continuation of the sprue in the cope. Two horizontal steel strips ¼ x 2½ inches extend from the center to a point on the outside where they may be grasped readily by the handles. The strips are tapered toward the edges. A tongue on the inner end of each rests in a mortise in the upright sprue and thus locates it at first and insures a clear passage when it is withdrawn. The outer end is finished to a convenient handle shape to facilitate withdrawing the strip.

One of the advantages of this type of gate is that the metal may be removed easily from the cleaned casting. Ordinarily it will break away clean, but even if a small stump is left it need not be removed. Its absence or presence is immaterial to the finished casting.

The two gates are not located diametrically opposite each other. To prevent cracking or distortion of the casting they are set about 30 degrees from a diametrical line as shown in the inset in the illustration Fig. 112.

This is the twentieth of a series of articles dealing with the various types of gates and risers used in the foundry industry. The twenty-first instalment will appear in an early issue—THE EDITORS.

New England Founders Hold Joint Meeting

Round table discussions of various foundry subjects featured the joint meeting of the New England Foundrymen's association and the Associated Brass Founders of New England, which was held in the Engineers' club, Boston, Wednesday, Oct. 14. Luther J. Anthony, Glenwood Range Co., Taunton, Mass, presided.

The gray iron group's discussion was under the direction of R. F. Harrington, Hunt-Spiller Mfg. Corp., Boston, and the nonferrous section was presided over by J. A. Duncan, Wm. Duncan Co., East Boston, Mass. The first portion of the gray iron round table was devoted to the subject of "shrinkage" and was followed by a discussion of general foundry problems. The first part of the nonferrous meeting featured the subject of porosity and this also was followed by a discussion of foundry problems.

A number of members took prominent part in the discussions and submitted castings, drawings and photographs to show the various difficulties which they had encountered. Due to the large attendance and the interest shown in the round table discussions, the executive committee of the New England group is planning another meeting of a similar nature to be held in the future.

Mussolini Addresses *Italian International* Foundry Congress in Rome

By Vincent Delport

European Manager, The Foundry

AN ACKNOWLEDGEMENT of the place of the foundry in industry and an indication of the growing importance of foundry congresses on a large scale were indicated by the fact that Benito Mussolini, head of the Italian government, presided at the closing session of the congress, which began in Milan on Sept. 12 and ended at the Capitole, in Rome, on Sept. 26. For the first time in the history of foundry congresses, a prime minister, and in this case the man who was responsible for bringing back order and prosperity to his country nine years ago, and who, since then, has personally conducted several departments of state, delivered the closing speech.

The congress, attended by about 1000 delegates, of which over 200 were foreign, was staged in a variety of wonderful settings, ranging from the modern industrial cities of Milan and Turin, and Italy's largest port, Genoa, to the highest mountains in Europe, seen from the iron ore mines at Cogne, and finally ending in Rome.

United Support Received

The inspirator and moving spirit of the congress and of the exhibition that was held in connection with it was Carlo Vanzetti, the leader of the Italian foundrymen, and managing director of Fonderia Milanese di Acciaio. He was assisted enthusiastically by his son, Dr. Ing. Guido Vanzetti and D. Brunelli-Bonetti, general secretary. The full support of the general Fascist Confederation of Italian Industry, the National Fascist Federation of the Mechanical & Metallurgical Industries, the National Fascist Association of Manufacturers of the Mechanical and Kindred Industries, and the National Fascist Association of Italian Metallurgical Manufacturers had been obtained, with the personal co-operation of the chairmen of these associations: A. S. Benni, F. Jarach, Count G. Monacelli-Lattanzi, and V. Ardissone respectively.

Technical sessions and the exhibition were held in the grounds and the pavilions of the Milan fair. The official opening of the congress was held on Saturday, Sept. 12, A. S. Benni giving the opening speech, which was followed by an address by Carlo Vanzetti. A. Damour, president of the International Committee of Foundry Technical associations, replied on behalf of all the foreign foundrymen, and greetings were then presented by Dr. Geilenkirchen, on behalf of the German foundry associations, J. Cury, on behalf of the French association, John Cameron, on behalf of the Insitute of British Foundrymen, and V. Delport, representing the American Foundrymen's association. The exhibition was opened the next day by Sig. Trigona, under-secretary of state for the minister of corporations, and in the presence of members of the Milan council and of the heads of the foreign delegations.

Visit Many Foundries

Among the works visited were the Fonderia Milanese di Acciaio Vanzetti, one of the leading steel foundries in Italy, which uses almost exclusively the electric furnace and is essentially modern in its equipment, efficient in its organization and renowned for the incentive given to its workmen. The Milan polytechnic was also visited. That renowned school is one of the best equipped in laboratories for electrotechnical study and research, and also for metallury. Other works visited in and around Milan were: Ercole Marcelli, Ernesto Breda, the Caproni airplane factory, the Stigler elevator works, the Isotta Fraschini automobile works, the Brescia works of the Italian National Radiator Co., the works of Franco Tosi at Legnano and of Vittorio Necchi at Pavia.

A number of sightseeing tours was arranged for the ladies, including a drive to lake Como by the "autostrada route," special roads exclusively built for automobile traffic. Official receptions were given by the Podesta or mayor of Milan and by the Provincial council of economy, while a lunch was offered to the principal foreign delegates by the National Fascist Federation of Mechanical and Metallurgical Industries. The banquet took place at the Hotel Continental in the evening of Tuesday, Sept. 15.

On Sept. 16 the group left Milan for Aosta, situated in one of the most beautiful valleys of the Italian Alps, and the next morning visited the Aosta steelworks.

Another group of visitors went over the foundry of the Olivetti typewriter manufacture at Ivrea. This foundry is equipped in the most modern and efficient manner, and is almost unique in Europe for the manufacture of typewriters on a mass production basis.

The visitors reached Turin on Friday evening and Saturday visited the foundries of the Fiat automobile works. Everyone was impressed by the intelligent adaptation of the most up-to-date methods to the particular problems that have to be solved by the company in their line of manufacture. On Sept. 20 the delegates reached Genoa, the largest commercial port in Italy.

Makes Heavy Castings

On Monday evening, Sept. 21, the entire party was conducted to the Ansaldo works, one of the largest heavy engineering concerns in Europe. Practically the whole of the works was occupied with the manufacture of parts and equipment for a superliner which is being built by the Navigazione Generale Italiana.

This liner the REX, will be about 50,000 tons. The gray iron and steel foundries of the Ansaldo works are capable of producing castings of the heaviest weight. The diesel engine shop was also extremely busy. Sept. 23 and 24 were devoted to an excursion in the province of Umbria, and a visit to the hydroelectric power plant of Terni.

The visitors arrived in Rome on the evening of Sept. 24. They were received at the Capitole by the governor of Rome, Prince Boncompagni Ludovisi, who conducted them

throughout the historical building of the Capitole. The closing meeting of the congress was also held in the Capitole on the morning of Saturday, Sept. 26, and was presided over by Benito Mussolini. The opening speech was made by the governor of Rome, followed by Carlo Vanzetti. A. Damour, president of the International Committee of Foundry Technical Associations, replied in the name of the visitors, and the final speech was made by the Duce, who, after having complimented the visitors on the interest of the congress, referred to the critical times which are being experienced by every country in the world in the following words: "Your congress has taken place during the days of great disturbance in the economic story of the world; from your work and your researches a moral can be drawn; without the fusion, in a spirit of unity, of all the operating goodwill of the world, the crisis from which we are suffering will last for a considerable time. It is necessary to work in order that this spirit of unity and international co-operation in all quarters may be realized in the practice of life; then all problems will find their logical and fruitful solutions." Sig. Mussolini then closed the congress in the name of the king of Italy.

Sessions Create Lively Discussion

TECHNICAL sessions were divided into four sections dealing respectively with cast iron and steel, nonferrous metals, sands, and general sundries. At the first meeting on Monday, Sept. 14, the first paper presented was the exchange paper of the American Foundrymen's association, "High Silicon Pig Iron for Malleable Iron Manufacture." by A. L. Boegehold, metallurgist, General Motors Research Laboratories, Detroit, and Carl Joseph, metallurgist, Saginaw Malleable Iron Co., Saginaw, Mich. This paper was presented by V. Delport, European manager, THE FOUNDRY. This was followed by the presentation of the exchange paper of the Belgian foundry association, entitled "Oxidation Considered as a Factor of Heredity," contributed by the scientific committee of the Belgian association and presented by J. Leonard, president of the association, and "Contribution to the Study of Heredity in Cast Irons," by Prof. H. Thyssen and B. Buffet.

Several points of interest were raised in the discussion which followed the presentaton of these papers. Mr. Leonard stated that the use of a deoxidizer in the manufacture of ingot molds has increased the life of the molds by as much as 30 or 40 per cent. He also stated that it is hardly possible to see the state of the oxidation of a bath from the superficial aspect. He is interested to see that Americans are making investigations on malleable cast iron similar to those being made in Europe on gray cast irons. Mr. Leonard said that in experiments made by the scientific committee of the Belgian association, it was found the formation of large and fine grains took place systematically in both cases. E. V. Ronceray said he thought Prof. Piwowarsky is right in saying that superheating has a beneficial influence on the final properties of the cast iron, but sometimes it creates an oxidation which may mask the good results of the superheating process.

Prof. A. Portevin said that the authors of "Oxidation Considered as a Factor of Heredity" are right in saying that measuring the total amount of oxygen is not sufficient to justify a definite conclusion, but inquired, in the case considered, how can one appreciate the state of oxidation of the cast iron? Blowing or addition of iron oxides does not change the total amount of oxygen. Some oxygen can be found in the form of various oxides. In cast iron, silicon is an active graphitizer, so one cannot tell whether it acts as a deoxidizer or as a graphitizer. The same can be said of aluminum. Prof. Piwowarsky agreed with Prof. Portevin, and said that investigations are being made to determine the oxygen in cast iron, but no method is as yet sufficiently exact to arrive at precise conclusions.

Referring to Prof. Thyssen's paper, one speaker stated it might be considered possible in the case of superheating that the larger flakes of graphite do not unite as easily as under normal circumstances. He added that existence of oxygen in the form of oxides may be a factor favoring separation of graphite flakes into smaller lamellae.

Referring to a recommendation of

Mussolini Addressing the Foundry Congress in the Capitole at Rome. At the Right Carlo Vanzetti, President of the Italian Foundrymen, Is Seated, and Next to Him Is F. Jarach, Chairman of the National Fascist Federation of the Mechanical and Metallurgical Industries. On the Left with His Head Turned toward Mussolini Is Prince Boncompagni Ludovisi, Governor of Rome

the author that the size of the graphite flakes in pig iron should be examined Prof. Portevin stated that recommendation is worthy of considerable attention, and the examination should be made in such a way that it could be translated with a degree of precision similar to chemical analysis. Mr. Vicaire, Aubrives-Vilerupt works, mentioned that it is his practice to order the iron not only on chemical analysis, but also on the size of the grain. Mr. Leonard pointed out that bad results obtained from the pig iron with the coarse grain were due to control and operation of the blast furnace.

Obtain Troostitic Structure

On the next paper, by R. Chavy, on "Hardened and Super-Hardened Cast Irons; Their Investigations and Recent Applications," Prof. Thyssen asked whether the deliberate development of martensite in gears did not result in brittleness. Mr. Chavy replied in the negative, but added that the final state of the iron was a troostitic structure, obtained after reheating.

The next three papers presented for discussion were: "Remarks on the Melting of Cast Iron Rolls in the Electric Furnace," by L. Del Grosso; "The Growth of Gray Cast Iron," by G. Calbiani, and "Notes on the Manufacture of Pearlitic Cast Iron in the Electric Furnace," by R. B. Dupuis, Fonderia Milanese di Acciaio. Replying to a question by Emile Ramas past-president of the French association, on the use of the duplex method of manufacture, Mr. Del Grosso said in the works with which he is associated electricity is obtained cheap, and the duplex system has not been used.

Referring especially to Mr. Calbiani's paper on "The Growth of Gray Cast Iron by Heating," A. Le Thomas said that the growth depends particularly on: Graphitization; cumulation of internal stresses due to inequalities of dilatation; the corrosion of particles of graphite, and the expansion due to gases. Graphitization is the most important and is due to rupture of a false equilibrium or metastable condition.

U. Gabino presented a paper entitled "Contribution to the Study of the Coulability of Metals. The Coulability of Steel."

G. Guzzoni presented a paper on "Hadfield Manganese Steels; Its Structure and Properties," and this was followed by a contribution by A. Le Thomas entitled "Certain Anomalies of Hardening in Cast Iron." One speaker referring to the latter mentioned that in chilled rolls certain parts at the bottom are harder than at the top. Mr. Ramas said that this experience is general and another speaker said the difference in hardness is due to pressure. Mr. Ramas remarked there are always two, and sometimes three, points around the roll where the hardening is less than in other parts. Another speaker stated that, on the basis of certain observed facts, he believed the hardening is related to the action of gas in the iron. By passing a flame around the casting, he noticed that the chill was less at those points where the gas became inflamed.

The exchange paper of the Institute of British Foundrymen was presented by Dr. A. L. Norbury, British Cast Iron Research association, and was entitled "Mechanical Properties of Malleable on Various Sized Test Bars." This was received with considerable interest and was followed by a paper describing a revolving, powdered fuel fired furnace and the results of operation.

Studies Effect of Aluminum

Professor G. Sirovich, Royal Engineering School of Rome, presented a paper on "The Influence of Small Additions of Aluminum in Gray Cast Iron," and was followed by a paper on "The Manufacture of Ingot Molds. Composition, Preparation of the Mold. and Causes of Rejection," by R. Travaglini and R. Comina. That paper closed the session on cast iron and steel.

Papers presented at the other sections were as follows: Nonferrous metal section: "Alloy 43 in Architecture," presented by Aluminum, Ltd., Ginevra; "Special Cupro-Nickels," by Dr. M. Ballay, exchange paper of the French technical foundry association; "Characteristics Relative to the Defects and to the Resistance in Aluminum Castings in Relation to the Pouring Temperature, to Cooling Methods and to Soluble Gases," by M. Barbero; "Volumetric Determination of Tin in White Bearing Metal Alloys," by D. Lombardo; "Aluminum Foundry Alloys in Aircraft Engine Construction," by C. Panseri; "The Analysis of Nickel and Chrome in Alloys and in Cast Iron," by V. Pestelli; "Note on the Pouring of Aluminum Plates for Rolling," by P. Pontremoli. In the sand section the following papers were included: "Certain Fundamental Problems Concerning the Control of Molding Sands, and Their Practical Realization in the Foundry," by Prof. P. Aulich, exchange paper of the German technical foundry association; "The Test for Complete Fineness in Sands and Loam," by G. Sulliotti and E. Capello, and "Contribution to the Study of the Permeability of Molding Sands," by H. Viez.

Cover Various Topics

In the general section the following papers were presented: "Distribution of the Electric Field in Alternating Current Arc Furnaces for Melting Steel," by G. Agostinelli; "Investigations on the Limit of Wear of Gray Cast Irons of Various Compositions," by E. Balma; "Organization of the Bronze and Iron Foundry of the Compagnie du Chemin de fer du Nord," by Mr. Castelain; "Tentative Systematic Classification of Foundry Defects," by C. Gierdziekewski; "Testing of Gray Iron for Machinability," by R. Mei, Olivetti foundry; "Foundry Factors and Defects. Metallography and the Foundry," by Prof. A. Portevin; "Standardization of Raw Materials and Semifinished Products in the Automobile," by V. Prever; "The Improvement of Products and the Reduction of Manufacturing Costs in the Foundry," by E. V. Ronceray; and "Investigations on the Danger of the Rupture of Cast Iron," by M. Ros and A. Eichinger.

Variety Features Milan Show

OVER 250 firms from various countries, but mostly from Italy, were represented at the exhibition in the Milan fair grounds. Motive power was available and enabled several exhibits to be shown in action. The exhibition was divided into five groups: Raw materials, castings, foundry equipment and supplies, technical section, retrospective exhibit.

The first group included ores, fuel, metals, fluxes and refractory materials. Among the foreign firms in that group were the International Bureau of Aluminum; Carborundum Co. Ltd., Manchester, England; Italian Driver-Harris Co., showing refractories; Beecroft & Partners Ltd., Sheffield, England, showing a range of fluxes and linings for cupolas and furnaces; French Comptoir des Fontes Hematites; General Refractories Ltd., Sheffield, England; Harrison Brothers, Middlesbrough, England, showing abrasives and polishing materials; Dutch blast-furnace works of Ymuiden; the Swedish firm of special steel, Sandvikens Jernverks Aktiebolag; the Hauts-Fourneaux de Saulnes (France); C. Tennant & Co. Ltd., London, showing pig iron and ferroalloys; and the Vereinigte Stahlwerke A. G., of Germany.

(Concluded on Page 58)

Place High Heads On Pressure Castings

By David Evans

AMONG the many features involved in the manufacture of steel castings, none exert greater influence on the soundness and strength of the product than the size and location of the gates and risers. This subject deserves most careful study if high grade work is to be turned out.

At a recent meeting of steel foundrymen, a discussion on this point disclosed a surprising lack of knowledge on the part of supposedly experienced foundrymen. They defended a commonly held theory that a riser is adequate if no cavities appear closer than ½-inch to the casting. The accompanying illustrations indicate the fallacy of this theory. In our practice we use risers so high and so large that all visible cavities appear in the upper two-thirds.

The riser from a 4-inch valve shown in Fig. 1 is a typical illustration. To show the unsound metal, the same riser was cut through at a different place as shown in Fig. 2. The cut was carried through the remaining third to where the riser joined the casting. The cut face was etched to reveal minute cavities and marked porosity, extending through approximately three quarters of the height of the riser. The margin of safety was reduced to one-fourth of the height. Even this last quarter cannot be considered sound metal. An area of softened, weak steel follows the tip of the spongy metal revealed by the etch.

Cavities Are Present

A graphic presentation of the feeding action is shown in Fig. 3, a sectional imaginary view of a typical, adequate riser. The large cavities in the first or upper section of the riser were caused by the subsidence of the liquid metal from between the riser walls. As the metal cooled further, it became pasty and the feeding action though retarded, still continued. The metal was *pulled in*. Minute cavities and spongy structure resulted. The defects arranged themselves in the shape of successive ar-

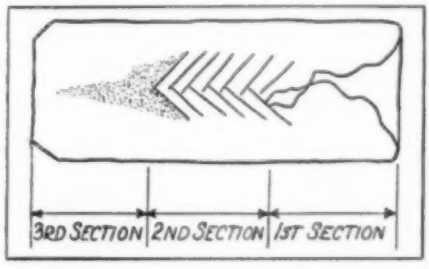


Fig. 3—Diagrammatic Sketch of Riser

row heads, pointing downward to the casting. This formation is quite distinct and apparent on the face of the riser shown in the illustration.

The final stage of the feeding action takes place when the metal has hardened further, but has not yet acquired strength. It weakens and softens the metal beyond the last faults visible by etching. An ample margin is necessary to insure that solid steel will be formed above the neck of the riser.

The practice of some foundry foremen to "Cheat on the size of the risers" throws a heavy burden on the cleaning room in the attempt to salvage castings containing large shrinkage holes under the risers. Also, it inevitably results in a heavier percentage of rejected castings after the customer has spent considerable time and money in machining them. It is done, of course, in an attempt to show a high yield of castings in proportion to metal melted. A high yield this month usually means a heavier percentage of returned castings next month.

The opposite extreme is based on the broad assumption that a heavy riser is a cure-all and a guarantee against defective castings. This practice also places an extra burden on the cleaning room besides cutting down the percentage of yield. Many castings are made without risers of any kind. Present reference applies particularly to valves and fittings. We never have seen a *pressure* casting produced satisfactorily without an intelligent knowledge of the size and location of risers.

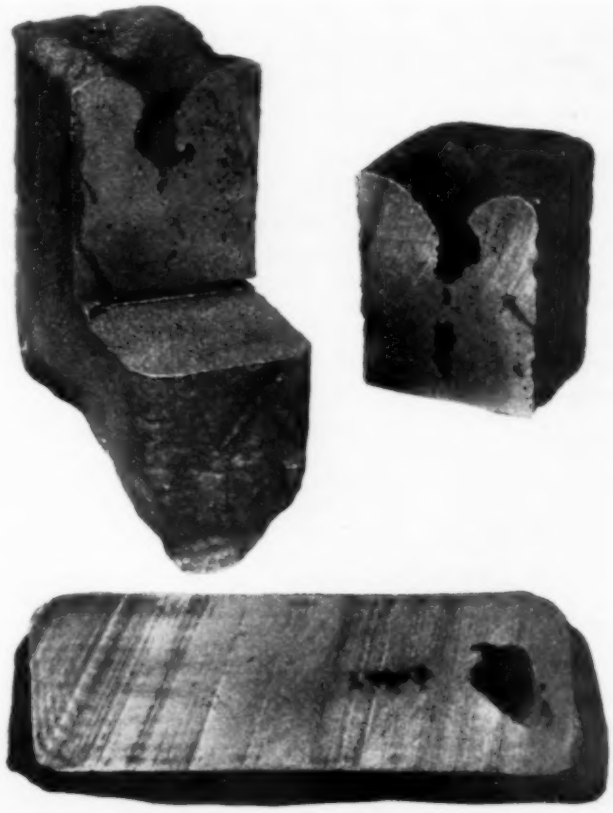


Fig. 1 (Top)—Riser From 4-inch Valve Showing Shrinkage Cavity Extending Deep Into the Riser. Fig. 2—(Bottom)—Section of the Riser Cut from Top To Bottom Showing Porosity for Three Fourths of the Distance

Nickel Affects Strength of Bronze Foundry Mixtures

By N. B. Pilling and T. E. Kihlgren

COMMERCIAL bronze foundry alloys consist of an almost innumerable variety of combinations of zinc, tin, lead, phosphorus and even other elements with copper. While the alloys in common use are so numerous, the greater part of the requirements of users of bronze castings is met by some half dozen or so somewhat loosely standardized types of mixture. In dealing with these, the foundryman is accustomed to a considerable amount of latitude in the adjustment of composition, and reaches satisfactory compromises in casting properties, physical properties and cost by the intelligent manipulation within reasonable limits of these elements.

Useful qualities of those mixtures depend not only on the proportion of the component elements present but to an important degree upon conditions under which the castings are produced, including the size and nature of the casting, type of mold, temperature of pouring and other factors. The complexity of all these conditions serves as an effective deterrent to the systematic study of this important group of engineering materials.

Nickel Is Present

Nickel is present commonly as an auxiliary modifying element in many bronze foundry mixtures for the purpose of accomplishing any of several purposes. For convenience, it is possible to consider nickel as having two principal kinds of action in bronze casting alloys, namely: Beneficial changes in physical properties and productive facility, and development of a white color and improvement in corrosion resistance.

The first group is, as a rule, concerned with rather small percentages of nickel, generally under 10 per cent and frequently as low as 1 per cent or less. The second group is related with higher percentages of nickel, almost always in excess of 10 per cent; these white, corrosion resistant bronzes are, in fact, the casting grades of nickel silver, with which our present interest is not concerned.

The copper-tin and copper-zinc series of alloys form the elemental basis of the casting bronzes, and the effect of small contents of nickel on the complex foundry alloys may be forecast roughly from the action of nickel on these two simple series.

Nickel is completely miscible in *alpha*-range copper-zinc alloys, even to the complete replacement of the copper content by nickel. That is to say, the presence of nickel leads to the development of no new constituent, and the zinc content marking the first appearance of the *beta* phase is but scarcely changed by the presence of even 20 or 30 per cent of nickel, according to Bauer and Hansen.

Considers Factors

WHILE there is an innumerable variety of combinations of copper, tin, zinc, lead and other elements used as commercial bronze foundry alloys, many of the requirements of users of bronze castings are met by a few somewhat loosely standardized types of mixtures. In many of the mixtures, nickel is present either as an unintentional or deliberate addition. Investigation of the effects of nickel on copper alloys usually is complicated by numerous factors, and the authors considered the latter in their work. This article is abstracted from a paper presented at the Chicago meeting of the American Foundrymen's association. The authors are associated with the Bayonne laboratory, International Nickel Co., Bayonne, N. J.

Increase the Ductility

In this case nickel, in solution, has its principal physical effect as a combined strengthening and toughening agent, frequently leading to an increase in ductility. On the other hand, the *alpha*-range of the copper-tin alloys is sharply restricted by nickel, as indicated by Price, Grant and Phillips, and Wise, and not only does the *alpha-delta* eutectoidal constituent appear at lower tin content as the nickel content rises, but a number of as yet obscure structural changes occur including the appearance of new phases and the disappearance of the eutectoidal structure within the *delta* constituent, according to Upthegrove, Wilson and Rhines.

It is evident that in the presence of tin the effects of nickel may thus become quite complicated. The principal physical effect in this case is a strengthening one, which at first may be accompanied by a rise in ductility but may also be followed by a loss of ductility with a sufficiently high content of nickel.

Roughly, equivalence in gross structure follows the substitution of nickel for a like amount of tin, and the desirable tin contents in bronzes containing much nickel are considearbly less than in the simple bronzes.

The strengthening and toughening effect of nickel is an important one and will be dealt with later. A number of investigators, including Johnson, Guillet, Comstock, Corse and Jeacock, have made scattering observations on this useful effect, which have resulted in the use of nickel bronzes in industry. Bronzes containing 5 to 10 per cent nickel retain their strength more completely at moderately high temperatures than do the simple bronzes, and a number of special mixtures for use in valves in steam engineering take advantage of this quality.

Raises Melting Point

Nickel quite generally raises the melting point of bronzes. A recent laboratory study shows the increase in liquidus temperature to be about 12 degrees Fahr. per 1 per cent nickel content if nickel replaces copper, or 32 degrees Fahr. per 1 per cent nickel content if nickel replaces tin.

Owing to a peculiar property not well understood, this does not develop a limit to its use, as in a number of cases nickel has been found to increase the fluidity of foundry bronzes, permitting either lower pouring temperatures in the face of a rise in melting point, or advantage to be taken of rather high nickel contents without loss of fluidity. This has been found to be the case in practical foundry operations, and has been confirmed in laboratory tests directed to determine the point.

A number of the casting properties of bronze mixtures, in addition to fluidity, are changed by small contents of nickel. Many of these are difficult to demonstrate experimentally but rest upon the practical observation of many foundrymen who have found useful effects to result from the inclusion of small percentages of nickel in their mixtures.

In this class are its densifying action, which is believed to facilitate the production of pressure-tight hydraulic castings, and its action in refining the grain and fracture of castings. Both of these effects may be manifestations of a tendency to minimize the incipient shrinkages described by Bolton and Weigand, and many others.

Attention to Deoxidation Necessary

In some cases a reduction of grain size and a marked increase in specific gravity have been noted to follow the introduction of nickel, although special attention to deoxidation appears to become necessary if the nickel content exceeds a few per cent. The effect of nickel in neutralizing unsoundness resulting from small contents of silicon and aluminum in a low tin content leaded bronze has been described by St. John, Eggleston and Rynalski, but otherwise there is little available information directed particularly to these obscure but useful actions.

Assistance received from nickel in

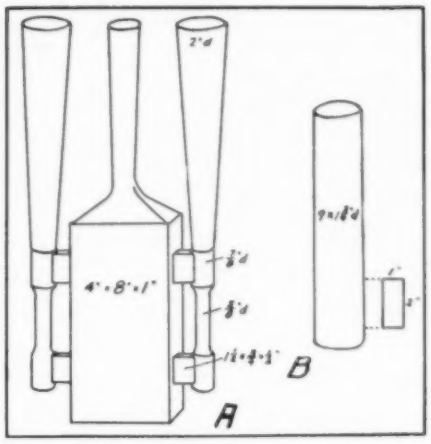


Fig. 1—Sketches of the Tension and Compression Test Specimens

effecting the dispersement of lead in highly leaded bronzes is well known, and some measurements have been made of the effect of nickel on the rate of wear of bearing bronzes by Staples, Dowell and Eggenschwiler.

A group of mixtures representing the types having general industrial importance has been selected upon which to show the effect of nickel on strength properties. Simple as the conception may be of changing the properties of a bronze casting alloy by the inclusion of a special element, such as nickel, the demonstration of such effects is not particularly easy. That is due to the well-recognized fact that many factors other than composition determine the quality and usefulness of a casting, and the accentuation of the effect of a minor compositional change requires the close control of many foundry conditions to a considerably greater degree than is necessary in ordinary foundry operations.

The mixtures under study were as follows: 1—An 11 per cent tin-bronze of the type commonly used in form gears. 2—A red brass—the common 85-5-5-5 mixture. 3—A yellow brass containing 1 per cent tin, 2 per cent lead. 4—G-bronze with 8 per cent tin, 4 per cent zinc. 5—The common 80-10-10 leaded bearing bronze. 6—A high lead content bearing bronze of the type used for locomotive brasses, with 6 per cent tin, 20 per cent lead.

In all of these mixtures nickel was introduced to replace a like amount of copper; the zinc, tin, lead and phosphorus contents remaining unchanged. Comparisons were made between a control melt free from nickel, and others containing nickel substitutions of approximately 0.5, 1.5 and 3 per cent.

Use New Metals

The melts were approximately 150 pounds in weight and were made entirely from new metals of high quality. These were ingot copper, ingot tin and lead. Horsehead zinc, electrolytic nickel and 15 per cent phos-

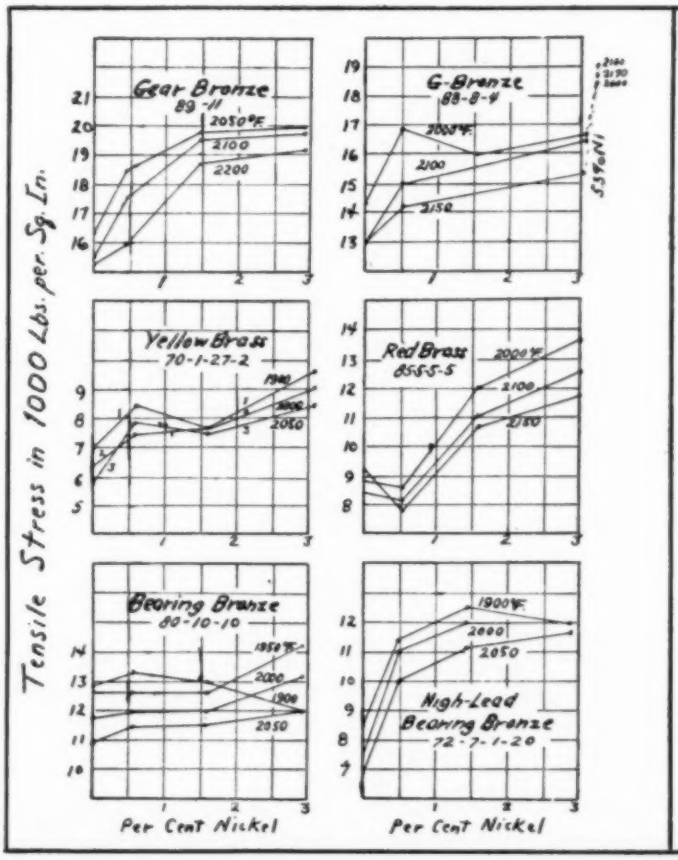


Fig. 2—Proportional Limit in Tension Varies with Changes in Pouring Temperature and Nickel Content.

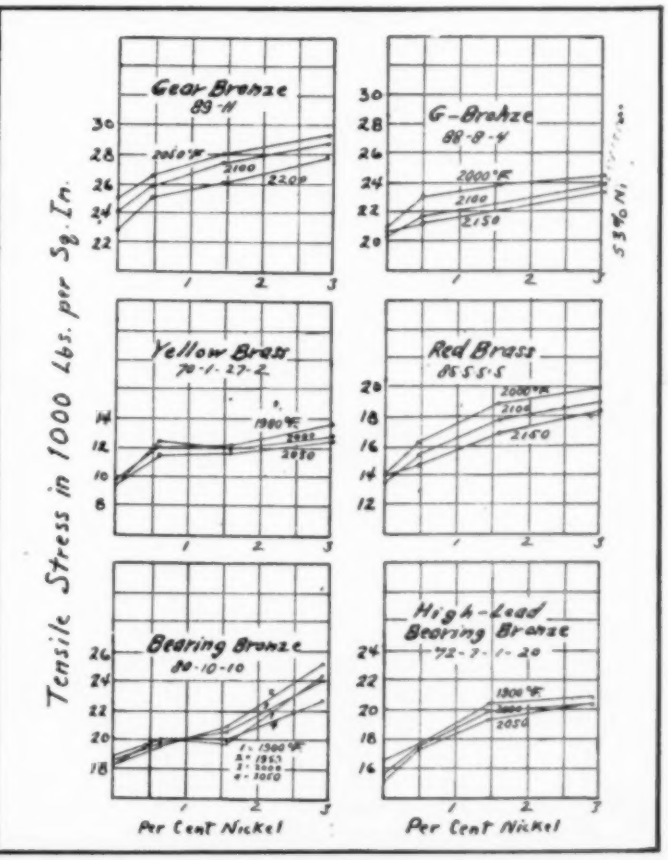


Fig. 3—Effect of Nickel on Yield Point in Tension at Different Pouring Temperatures

Table I

Composition of Bronze Mixtures

Type	Heat No.	Cu	Ni	Sn	Zn	Pb	P	Note
Gear Bronze	1	88.67	tr	11.38	.....	.....	.030	*a*
	2	88.70	.03	11.12	.....	.....	.026	*b*
	3	88.26	.47	11.03	.....	.....	.030	
	4	87.14	1.47	11.34	.....	.....	.021	
	5	85.82	2.94	11.13	.....	.....	.013	
G-Bronze	6	87.95	.02	8.39	3.57	.....	.027	
	7	87.67	.58	7.91	3.66	.....	.028	
	8	86.13	1.70	8.43	3.65	.....	.047	
	9	85.11	3.21	7.90	3.60	.....	.036	
	10	82.64	5.32	7.96	4.02	.....	.015	*c*
Red Brass	11	83.85	.03	4.83	5.22	6.01	.036	
	12	83.60	.48	4.93	5.07	5.83	.036	
	13	81.93	1.60	5.12	5.14	6.13	.036	
	14	81.30	3.03	5.00	4.65	5.94	.040	
Yellow Brass	15	70.90	.03	1.08	25.22	2.60	.037	
	16	69.03	.62	1.18	26.62	2.49	.030	*c*
	17	71.08	1.63	1.32	23.56	2.33	.033	*c*
	18	68.23	3.07	1.28	25.05	2.30	.028	*c*
Bearing Bronze	19	78.45	.03	10.02	.....	11.44	.041	
	20	77.64	.67	10.06	.....	11.56	.037	
	21	77.28	1.57	9.84	.....	11.24	.027	
	22	75.14	2.92	10.34	.....	11.55	.021	
High-Lead Bearing Bronze	23	67.50	nil	6.21	1.49	24.90	.024	
	24	68.99	.23	7.02	1.13	22.55	.021	*b, c*
	25	70.08	.47	7.10	1.30	21.08	.030	*c*
	26	69.90	1.46	7.36	1.18	19.93	.035	*c*
	27	67.86	2.88	6.10	1.02	22.25	.012	*c*

a—tension test specimens only. *b*—compression test specimens only. *c*—50 per cent cupro-nickel used in preparation.

phor-copper. In a few cases the nickel content was supplied as 50 per cent cupro-nickel, previously prepared from electrolytic nickel.

Copper and nickel were melted down under a charcoal cover in crucibles in a pit furnace fueled with low sulphur content oil and with a slightly oxidizing flame. After fusion, tin and zinc were added the lead addition being delayed until just before the pot was ready for withdrawal from the pit. Before pouring, the melts were deoxidized with about 0.05 per cent phosphorus and vigorously stirred with a graphite rod. The composition of these experimental heats is given in Table I.

After experimentation with a number of designs of test casting, including variations in gating and disposition of risers, the pattern shown in Fig. 1-*A* was chosen for tension test specimens. This developed a good combination of properties which could be reproduced satisfactorily in check melts.

Temperature Affects Properties

The test specimen was standard, threaded-end, 0.505-inch diameter machined from these blanks, the outer skin of the casting being removed. The compression test specimen, Fig. 1-*B*, consisted of a cylinder of 1 inch diameter, 2 inches long, with parallel ends, machined from the core of a large cast cylinder near the base.

Pouring temperature has a profound effect upon the properties of many bronzes, and in the present series of tests, castings were secured from a number of different pouring

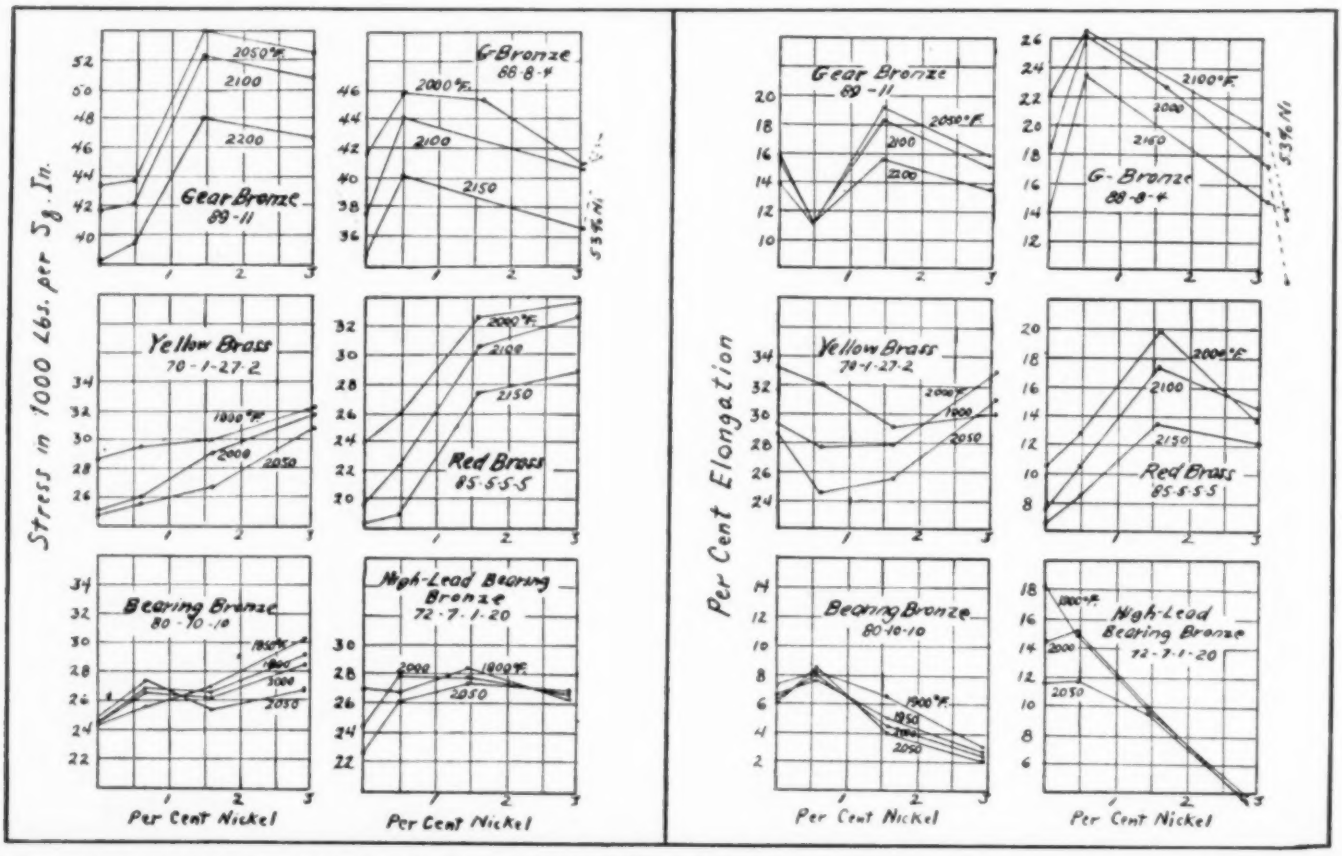


Fig. 4—Showing the Changes in Tensile Strength with Different Nickel Contents and Pouring Temperatures. Fig. 5—Different Pouring Temperatures and Nickel Contents Affect the Elongation

temperatures. The melt was brought to the maximum temperature required, the degree of superheat being controlled by a robust immersion couple operating upon the crucible contents in place in the melting pit.

After removal from the pit the metal temperature was measured with a light-weight, chromel-alumel immersion couple, and a flask was poured. At appropriate intervals as the pot cooled off, other flasks were poured, the temperature for each being determined with a fresh junction.

Generally, tension and compression specimens were cast alternately, the last flask being poured close to or within the freezing range. The result was a series of test specimens distributed over a range of temperatures usually extending to 500 degrees Fahr. above the melting point.

Test results are shown in Figs. 2 to 7 inclusive. The effect of nickel is brought out clearly in the change in a selected group of properties for three different temperatures of pouring.

Table II

Resistance to Incipient Deformation

Mixture	Ni per cent	Per cent increase in PL* tension	PL* Compression	Yield point	10 per cent Compression
Gear Bronze	2	25	25	15	20
G-Bronze	1.5	20	5	10	5
Red Brass	3	40	55	40	30
Yellow Brass	3	40	35	35	40
Bearing Bronze	1.5	5	15	10	15
High Lead Bronze	1	50	30	20	15

*PL is abbreviation for proportional limit.

Increases Physical Properties

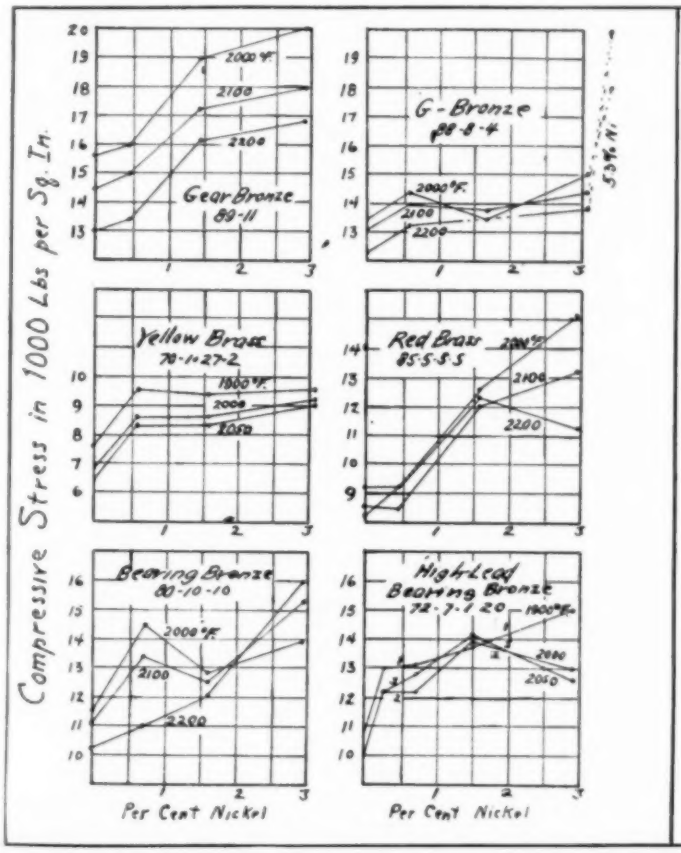
Proportional limits in tension and compression, yield point, ultimate strength and resistance to compression of gear bronze are raised by successive additions of nickel, and it appears that this is accomplished with no loss of ductility up to at least 3 per cent nickel. As would be expected from its high tin content, the mixture is rather sensitive to pouring temperature, and nickel alters this quality to no perceptible degree. The present tests suggest an optimum nickel content of about 2 per cent.

While the resistance of G-bronze to comparatively slight degrees of deformation, as indicated by proportional limit and yield point, increase continuously with a rise in nickel content up to at least 5 per cent, breaking strength and elongation reach their best proportions at about 1½ per cent nickel content.

Red brass responds to nickel. The strength properties both in tension and in compression rise continuously to beyond 3 per cent nickel, while at the same time ductility is considerably increased to a maximum at about 2 per cent nickel. The toughness (product of strength × elongation) of 3 per cent nickel red brass was found to be over twice that of the nickel-free mixture.

Yellow brass is improved by nickel contents. Tensile strength, yield point and proportional limit, as well as the compressive strength properties, all rise quite rapidly with increasing contents of nickel, with elongation maintained at a high value. There is no indication that the useful effect of nickel terminates at any low percentage, but the most rapid and economically useful improvement in strength occurs with the first per cent of nickel content.

Successive additions of nickel raise the strength characteristics of



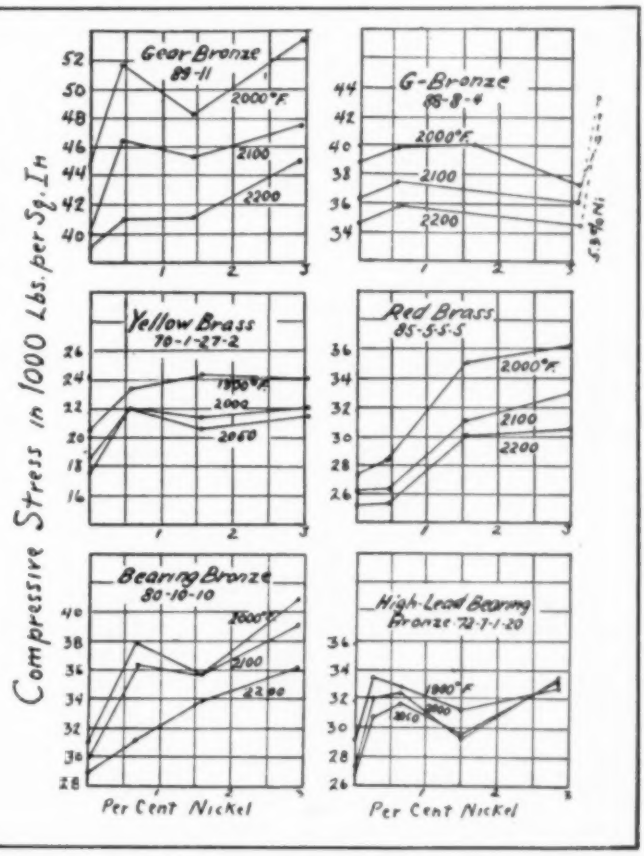


Fig. 6.—Proportional Limit in Compression Changes with Variations in Nickel Content and Pouring Temperature. Fig. 7—Effect of Nickel on Resistance to 10 Per Cent Compression at Various Pouring Temperatures

bearing bronze but a limit is reached at which further increases in nickel diminish the ductility. This limit appears to be about 1½ per cent nickel content.

While similar in many respects to the mixture just discussed, the high lead content alloy responds even more quickly to nickel, and its most desirable effect is reached at about 1 per cent nickel content. Higher amounts reduce both elongation and toughness.

Considered in a general way, it appears that the tensile strength, compressive resistance and elastic strength of all six foundry mixtures are improved by small contents of nickel.

Content Varies With Base

The best nickel content varies with the nature of the base mixture and, in general, is lower, the higher the tin or lead contents. When the e last two elements are limited to perhaps 1 or 2 per cent each, the advantageous action of nickel in increasing strength and toughness may be extended to contents which are certainly higher than the range considered in this investigation.

It seems to be a general characteristic of nickel to increase such properties as proportional limit and yield point to a considerably greater extent than would be expected from the change in tensile strength. In other words, nickel displays its strengthening action most markedly when the deformation involved is small.

The importance of this in connection with castings subjected to service of such nature that failure may occur by distortion rather than by fracture is, of course, evident. The extent to which the resistance of sand-cast test specimens to incipient deformation has been increased by appropriate nickel contents is briefly summarized in Table II.

These changes in strength properties which have been discussed are in part understandable from the microstructural changes which accompany them. For a given pouring temperature, bronzes containing the *delta* constituent show somewhat greater amounts of it in the presence of nickel, and the lead-rich constituent of the highly leaded alloys develops an involved surface of contact with the matrix in which it is embedded. It seems probable that nickel also dissolves in and hardens the alpha solution.

Structurally, both G-bronze and yellow brass are scarcely affected by as much as 3 per cent nickel, although the latter has its strength properties considerably raised.

International-Stacey Corp., Columbus, O., has purchased the Stacey Mfg. Co., Cincinnati.

Variety Features Show at Milan

(*Concluded from Page* 52)

The second group displayed a variety of castings, industrial, hardware and artistic castings, sent by the leading foundries of Italy, France, Great Britain, Czechoslovakia. Among the Italian firms represented were the Italian Westinghouse Co. and the Italian Driver-Harris Co.

The third group was divided into several sections. In the furnace section the Italian Driver-Harris company showed drying ovens and heat-treating furnaces; Fachantalt fur Neuzeithches Giessereiwesen, Halle-Saale (Germany), showed melting furnaces; the Stein concern, of Paris, exhibited a powdered coal rotary furnace; the Societe d'Enterprises Speciales de Chauffage Industrial displayed a model and photographs of a rotary furnace. Various sizes of arc furnaces were conspicuous on Italian stands: Italian Brown-Boveri, Soc. Commerciale Elettrotecnica Italiana, Soc. Forni Elettrici Alta Temperaturo.

Sand-preparing plant was exhibited by Badische Maschinenfabrik and Eisengiesserein, Durlach, Germany; A. Baillot & Cie., Paris; E. Gernelle-Danloy, Reims, France; Peter Hammers, Karlsruhe, Germany. Molding machines could be seen on the stands of Osborn Mfg. Co., Cleveland; Badische Maschinenfabrik; A. Baillot et Cie.; Bonvillain et Ronceray; Giesserei und Werkzeugmaschinen, Frankfort, Germany, who showed machines made by the Tabor Mfg. Co., Philadelphia; Swiss firm of Georg Fisher, who showed machines made by the W. H. Nichols Co. Inc., Richmond Hill, Long Island, N. Y.; A. Utard, France; and Gustav Zimmerman, Dusseldorf. In another section the Italian Alfred Herbert company, a subsidiary of the British firm, showed abrasive wheels and products of the Norton Co. A number of the firms already mentioned, together with the Demag corporation, Duisberg, Germany, showed transportation and handling equipment. Measuring and laboratory equipment was also exhibited, and the British firm of Vickers-Armstrong Ltd. was represented. The large number of Italian firms which exhibited their products proved that the country has developed its industries to a considerable extent, and that, with the exception of certain specialties, Italy is equipped to supply more and more of her industrial requirements, while the country is in the forefront for all matters related to the production and utilization of electricity.

The technical and professional section of the exhibition was composed of photographs, charts, castings, test pieces, laboratory equipment, etc., supplied by the various technical schools and associations of Italy, and the foreign section was composed of exhibits from Belgium, France and Germany. The technical press was fully represented and included the range of periodicals published by the Penton Publishing Co. and its associated companies. The retrospective group showed castings going back to antiquity, and models of furnaces and equipment such as were used many years back. The original Stassano electric furnace and many old Roman castings were included.

Prepares Schedule for Foundry Congresses

The annual meeting of the International Committee of Foundry Technical associations was held in Milan, Italy, on Monday, Sept. 14, during the foundry congress, A. Damour, past-president of the French technical association, being in the chair. The following countries were represented: Belgium, Czechoslovakia, France, Germany, Great Britain, Holland, Italy, Luxemburg, Poland and the United States.

John Cameron, representing the Institute of British Foundrymen, and V. Delport, representing the American Foundrymen's association, presented motions with a view to regulating the system of official exchange papers, which have become a more and more important feature of international congresses. A discussion followed on the proposed international foundry technical dictionary; it was decided that J. M. Espana should centralize the work, and, through the honorary secretary of the International committee, Tom Makemson, send an invitation to the various associations to assist in the preparation of the dictionary, the International committee giving solely its moral support.

The schedule of foundry congresses was made up to 1936 as follows: 1932, Fourth International Foundry Congress, with official American participation in Paris, France; 1933, international congress in Czecho-Slovakia; 1934, Fifth International Foundry Congress in the United States; 1935, international congress in Brussels, Belgium; 1936, Sixth International Foundry Congress, with official American participation in Germany. Tom Makemson attended the meeting in his capacity of honorary secretary, and was assisted by Guido Vanzetti. Carlo Vanzetti, president of the congress, entertained the delegates to lunch after the meeting.

Great Britain was unanimously elected to name the president of the International Committee of Foundry Technical associations for the year 1932, and Holland was designated to name the vice president.

Uses Point System To Compute Molding Piece Rates

By W. J. MacNeill

THE point system for determining molding piece rates in use at the Federal Malleable Co., West Allis, Wis., was developed more than 10 years ago by the Malleable Iron Research institute. This method has been used in the Federal plant since 1922 with only slight alterations, and has been found most satisfactory for rating squeezer and bench molding jobs.

Simple Method

WHERE the foundry does not have facilities available for timestudies of various operations, the author believes that the point system offers a simple, reliable method of establishing equitable molding piece rates. In addition, it is of considerable advantage to the sales department in estimating, often permitting the salesman to make a close estimate of the molding cost of a job without returning to the plant to confer with the foundry superintendent. This article is abstracted from a paper presented at the Chicago convention of the American Foundrymen's association. The author is superintendent, Federal Malleable Co., Milwaukee.

Application of the point system consists of assigning values to each part of the mold-making operation, these values being expressed in points. The sum of the points represents the total value of the various operations required for making the mold, but does not express this value as a price per mold. To convert the total points into a price per 100 molds, this total must be multiplied by an hourly earning coefficient. To this product is added the pouring, which, in our shop, is paid for at the rate of 10 cents per hundred-weight of casting weight per 100 molds.

The basis of the point system under discussion is given in the tabulation of point values and hourly earning coefficients of the accompanying table. Take as an example, a casting weighing ½ pound that may be molded 10 pieces to the flask, 10 x 16 x 7 inches. The casting requiries no cores, is made on a squeezer machine from plate type pattern equipment. Total piece rate per 100 molds is calculated in the following manner:

Sand (10 x 16 x 7) = 1120 cu. in. @ 30 pts. per cu. in. (33.6)	.34
Cores and chills—none	
Pattern equipment—plate on squeezer	.12
Total points	.46
Hourly rate desired, 70c	×7
	3.22
Casting weight per mold, 5.0 lbs.—per 100 molds, 500 lbs., @ 10c per cwt.	.50
Total piece rate per 100 molds	$3.72

Another example shows the use of the point system where the mold is hand rammed. Assume a casting weighing 6 pounds that may be molded two in a flask, 12 x 20 x 10 inches. The casting requires one large and one medium sized core. A hand pattern is available. Calculating the total piece rate per 100 molds is carried out in the following manner:

Sand (12 x 20 x 10) = 2400 cu. in—	
2000 cu. in. @ 30 per M	.60
400 cu. in. @ 50 per M	.20
Cores—2 large @ 4, 2 medium @ 3	.14
Equipment—1 hand pattern, hand rammed	.20
Total points	1.14
Hourly rate desired, 80c	×8
	9.12
Pouring——12 lbs. per mold, 1200 lbs. per 100 molds, @ 10c per cwt.	1.20
Total piece rate per 100 molds	$10.32

From these examples it will be noted that, for convenience in converting total points into dollars per 100 molds points should be considered as cents so that the multiplication by the coefficient gives a direct answer in dollars and cents and no confusion results in pointing off the proper number of decimal places.

The point system as outlined may

(*Concluded on Page* 73)

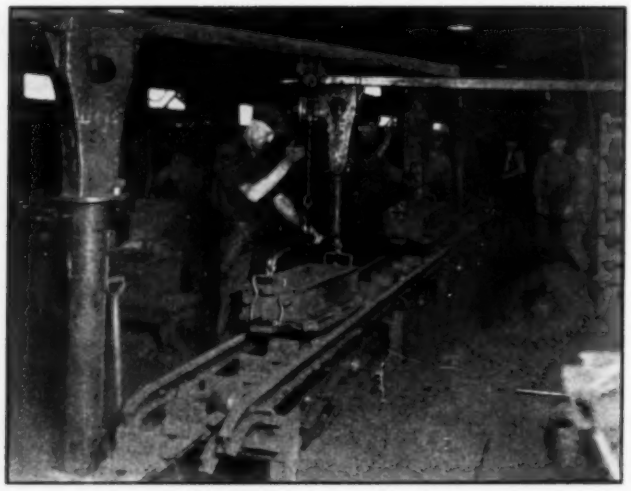
Point Values and Hourly Earning Coefficients

Operation.	Points
Sand Handling	30 for each cu. in. of flask content 50 for each 100 cu. in. of flask content above 2000
Chills	1 for each chill which can be dropped in place 2 for each chill which must be set carefully
Bands	2 for each band placed in mold
Core Setting	1 for each small core dropped into place 2 for each small core set into place 3 for each medium core set into place 4 for each large core set into place 6 for each small complex core set into place 8 for each large complex core set into place
Handling Equipment	12 for each plate pattern of 1 gate for squeezer 2 for each additional gate 14 for each frame pattern of 1 gate for squeezer 2 for each additional duplicate gate 17 for each hand pattern for squeezer 17 for each hand pattern for squeezer 4 for each additional duplicate of gate 6 for each additional different gate 17 for each plate pattern hand rammed 20 for each hand pattern hand rammed 4 for each additional duplicate gate 6 for each additional different gate

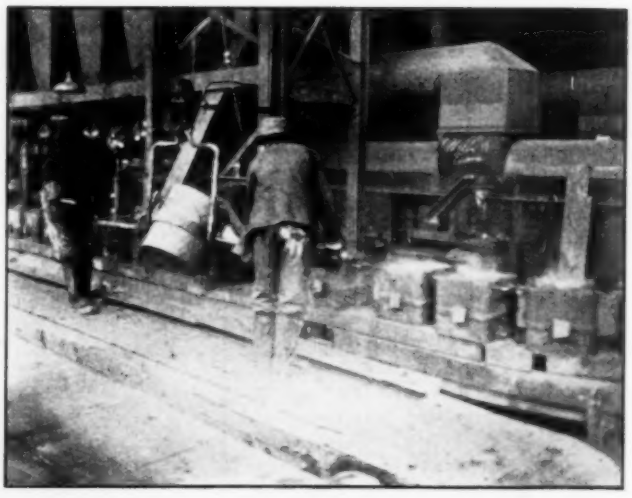
Hourly earning desired	50c	55c	60c	70c	75c	80c	90c	1.00	1.10
Coefficient	5	5½	6	7	7½	8	9	10	11

Pouring 10c per cwt. of casting weight per 100 molds.

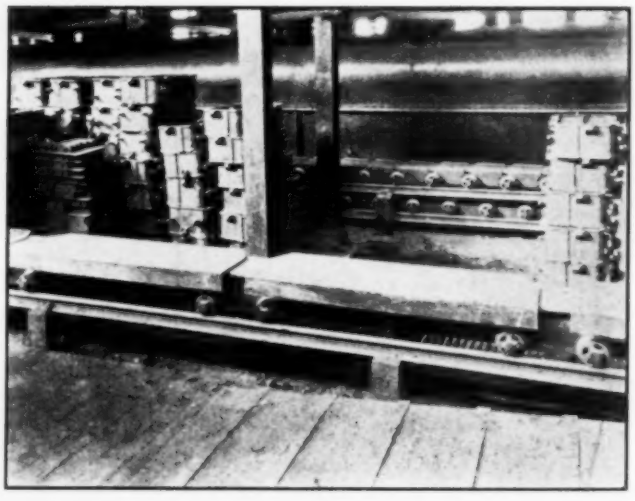
Chevrolet Speeds With

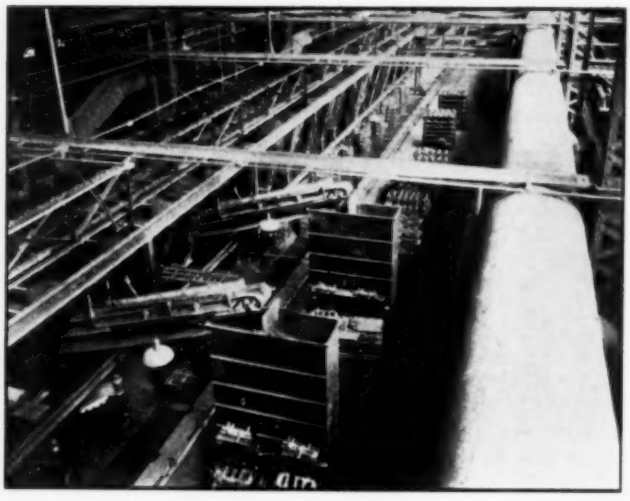


Above—Special Attachments Handle the Drags and Bottom Plates and Swing Them Into Place on the Moving Conveyor. Right—Molds Are Poured from a Small Crane Ladle

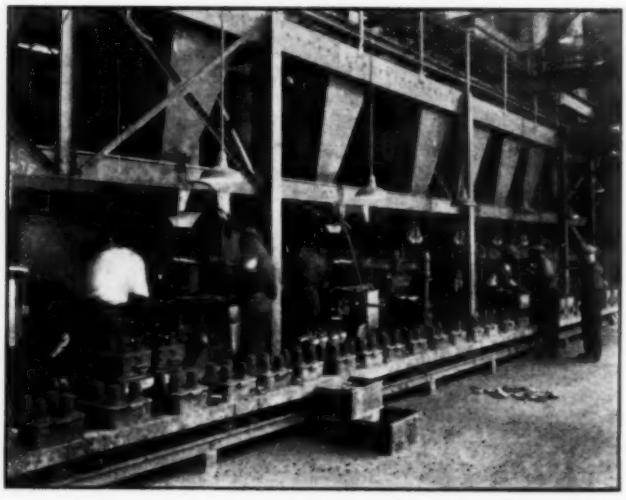


Above—Copes Are Lowered Into Place on Drags Moving on a Sliding Conveyor. Right—Small Trucks Mounted on Wheels Carry the Molds on Some Conveyor Lines

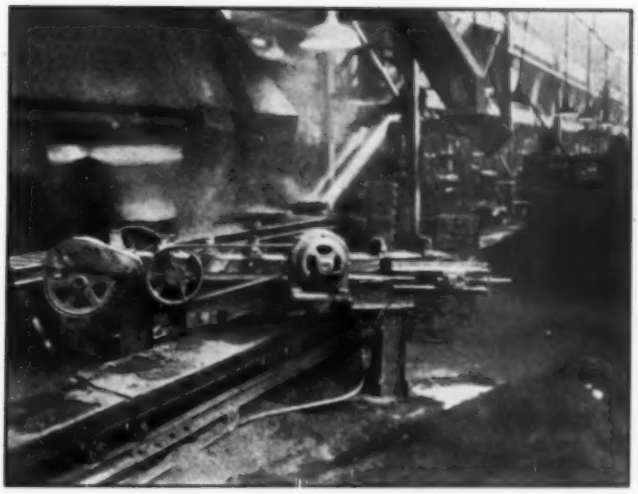


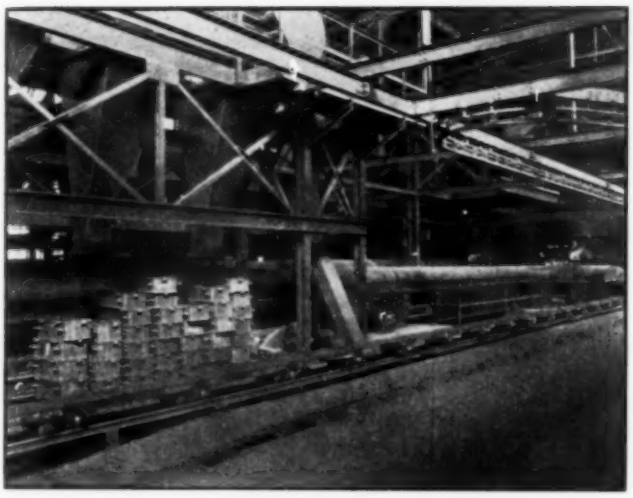


Above—General View of Conveying System for Carrying Sand To the Coremaking Stations. Right—Piston Molds Are Made on Machines Behind the Car Type Conveyor

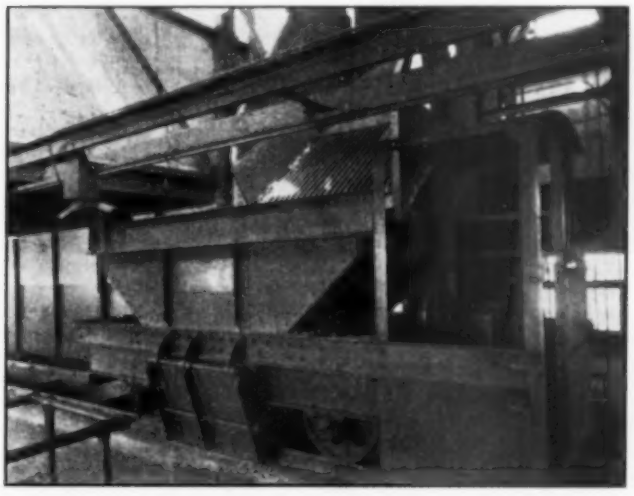


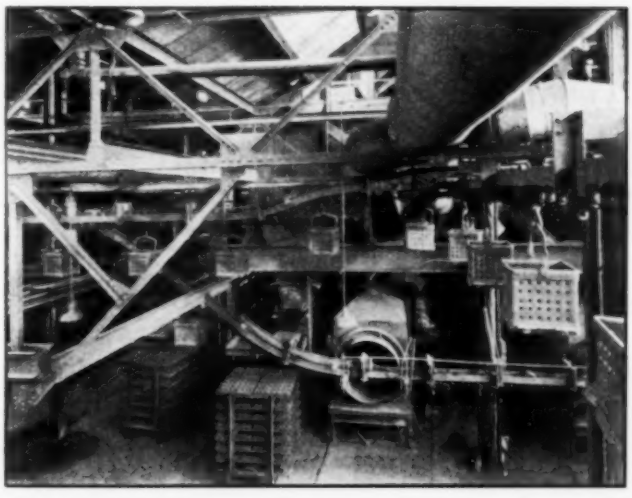
Foundry Output Conveyors



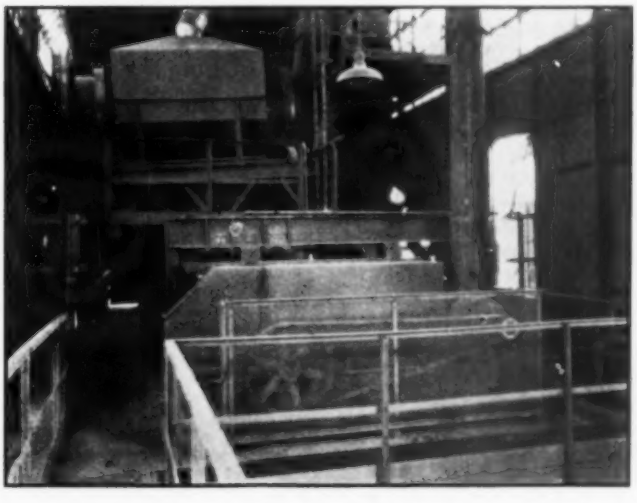


Left—General View of One of the Molding Units with Empty Flasks in Left Foreground. Above—Brushing Equipment Is Employed for Cleaning the Conveyors





Above—A Larry Conveys Coke from the Elevator to the Bunkers Back of the Cupolas. Left—Hot Castings Are Carried Away on Over Head Conveyor Lines



Above—One of Several Units in Which the Sand Is Prepared Mechanically. Left—Castings Are Unloaded Directly from Conveyor Baskets into the Tumbling Barrels

Illustrations Courtesy C. O. Bartlett & Snow Co.

Questions & Answers on FOUNDRY PRACTICE

THIS department covers all problems relating to metallurgical, melting and molding practice encountered in making steel, malleable-iron and gray-iron castings. Questions submitted by bonafide subscribers to this department will be answered by members of the editorial staff of The Foundry, supplemented where occasion requires by the advisory staff whose personnel is as follows:

John H. Hall
Cast Steel

H. A. Schwartz
Malleable Cast Iron

J. W. Bolton
Gray Cast Iron

All questions must be addressed to the Editor, The Foundry, Penton Building, Cleveland.

STEEL

Uses Permanent Molds

We are interested in the possibility of applying permanent molds to the casting of a high nickel-chromium alloy whose melting point is about 2400 degrees Fahr. At present we are casting the alloy into green sand molds; the alloy in the furnace is about 2950 degrees Fahr., and we imagine that the alloy is at a temperature of 2850 degrees when it enters the mold. We also are thinking of employing the centrifugal process with a permanent mold.

From time to time reports are heard about experimental applications of metal molds for steel casting, but usually for some reason or other the work is dropped before definite results are forthcoming. One of the reasons in the past was that the large bottom pour ladles used for steel casting allowed the metal to overflow the mold, and the mold usually had to be broken apart to obtain the casting. However, the casting obtained in the permanent molds were said to be all right, and if the present practice of using hand shanks for pouring were employed, there seems to be no reason why metal molds could not be used for certain castings.

We believe that the permanent mold process would be limited to comparatively simple shapes for steel casting, and your particular alloy has many of the characteristics of steel, due to certain inherent qualities. Steel usually contracts about ¼-inch per foot, and allowance will have to be made for that feature. It also is quite tender during certain stages of solidification, and tears easily if anything prevents its contraction.

Some time ago Leon Cammen claimed to have developed a method for centrifugally casting steel tubes which is described to some extent in the *Transactions* of the American Foundrymen's association, 1926. Metal molds of special composition or with special linings are employed. We know of one firm that employs heavy steel pipes lined with rammed sand which is dried for producing centrifugally cast alloy steel tubes, and there may be others.

GRAY IRON

Crusher Needs Strength

We are making rock crusher castings, consisting mainly of plates, back plates and hammers, out of a mixture composed of 35 per cent machinery scrap and 65 per cent steel scrap. Lump ferromanganese is added to the ladle in the proportion of one-half pound per 100 pounds of iron. The castings were exceptionally good but we have had some trouble with the hammers and back plates breaking after being partly worn out. Can you tell us how to make the castings stronger without sacrificing the wearing quality?

A rough calculation of the mixture you use shows an analysis of 0.50 per cent silicon; 0.30 per cent manganese and 0.25 per cent phosphorus. Unless the castings are exceptionally heavy we believe that the silicon is low for crusher work and should be raised to around 1 per cent by the addition of ferrosilicon in the ladle or by substituting some fairly high silicon pig iron for the machinery scrap. Your manganese is quite low and believe that you can obtain better results by increasing it to around 0.80 per cent. That will necessitate increasing your ferromanganese addition to 1 pound per 100 pounds of metal.

In adding ferroalloys to the ladle it usually is good practice to heat the alloy almost red hot before adding. When added in that manner there is less loss of heat in the ladle. The ferroalloy also dissolves more easily and therefore is incorporated into the bath more rapidly.

Q & A

Sand Is too Tight

We have been making punch holders for a local firm for some time, and recently have been having trouble with them. The castings are 7 x 9½ inches and 2 inches thick with a cylindrical stem 3¼ inches in diameter and 3 inches long projecting from the rectangular surface. The sand used is Olcan sand and is rather close. Our iron charges consist of 200 pounds of No. 1 pig, and 800 pounds of agricultural machinery scrap, auto blocks and return scrap.

The defective stems result from two causes. The main trouble apparently is due to blowholes caused by the sand which you mention as being close, and it is possible that the sand is being worked too wet. Sands that contain considerable bond will carry more water than those with less bond without that fact being noticeable. Therefore, we suggest that you try a more open sand for making the castings. If such sand is not available, make up an experimental heap using your present sand mixed with clean sharp or

core sand to open it up sufficiently.

The second cause is due to the structure of the iron which is coarse and open, and we suggest that you close it up by changing your mixture to the following: 200 pounds of No. 1 pig iron; 100 pounds of steel scrap such as rail ends, and 700 pounds of scrap. The analysis of your present mixture shows roughly about 2.0 per cent silicon while that of the suggested mixture will contain about 1.75 per cent silicon.

GENERAL

Obtains Blue Finish

Can you supply a formula for bluing polished gray iron castings? The finish is supposed to resemble that of gun metal.

Several methods have been suggested for producing a blue color on iron and steel. A gun metal finish on steel is obtained by immersing the polished pieces in molten sodium nitrate for about two minutes. The pieces are removed and allowed to cool somewhat, then washed in hot water, dried and oiled with linseed or paraffine oil. The temperature of the molten nitrate bath should be between 700 and 800 degrees Fahr. Another method for bluing steel employs a solution containing one pound of iron chloride; 0.5-ounce of copper sulphate; 4 ounces of hydrochloric acid; 0.5-ounce of nitric acid, and 1 gallon of water. Have the solution at the boiling point and immerse the objects for 15 minutes. Remove and allow to dry for several hours. Place the objects back in the solution for 15 minutes, and then take out and allow to dry for 10 hours. Place in boiling water for ½-hour. Dry and scratch brush lightly on a fine steel wire wheel. Then oil with linseed or paraffine oil.

While those methods are given for steel, we believe that they will work with gray iron with perhaps a little experimenting on your part. The first method using heat may require careful procedure to prevent cracking or distortion when rinsing in hot water. It may be well to determine the best cooling point before rinsing at which good results are obtained. Another suggested method is to polish and clean the casting with lime. Then brush over a mixture of 8 parts of butter of antimony; 8 parts of fuming nitric acid and 16 parts of hydrochloric acid. The hydrochloric acid should be added slowly to the mixture to prevent heating. Apply the mixture with a rag, and then rub with green, young oak wood until the desired blue color is obtained.

Problems in Nonferrous Founding

By Charles Vickers

MakesManganeseBronze

We have a quantity of good clean yellow brass scrap, which we desire to use up in making strong, tough castings. We have used manganese bronze in the past for the grade of work in which we desire to use up the yellow brass, and we have always bought manganese bronze ingot. Possibly there may be something in the market that can be used in connection with yellow brass to give the strength and toughness of manganese bronze, and if so can you advise us where to get it?

Success or failure in using brass scrap for making manganese bronze, depends entirely on the kind of scrap it happens to be, and also on knowing positively the analysis of this scrap material. It is not possible to melt such a material as sheet brass clippings or other waste stock, and simply add manganese, or one of the many so-called hardeners for making manganese bronze, and expect to get real manganese bronze. The result will be simply yellow brass, no doubt aluminized and incapable of running a clean casting, much less one that will be strong and tough.

The first move to make in using this scrap metal, therefore, is to have an analysis made by a chemist of repute. If this scrap brass is cast brass, it will not be necessary to analyse it for making manganese bronze, for it is not suitable for such metal. However, it ought to be analysed in order to know how to use it profitably in making red brass and bronzes.

The scrap must be rolled material. It may be composed of 70 per cent copper, 30 per cent zinc, and if so it is advisable to obtain some good manganese bronze hardener, preferably one containing aluminum. The hardener is melted with the scrap in the proper proportions, about which it will be necessary to consult the manufacturer, and then the proper proportion of zinc is added. The latter should be sufficient to bring the total zinc content up to 40 per cent of the whole. This will give a manganese bronze, provided care has been taken to get the hardener thoroughly incorporated. The hardener known as *steel alloy* is not to be recommended for making a manganese bronze from scrap. That alloy contains iron manganese, and tin, while the type of hardener suggested contains copper, iron, manganese and aluminum.

Q & A

Bushing Has Holes

We are trying to make bushings using a pure ingot which is supposedly of 88 copper; 10 tin; 2 zinc. We cast the bushings on end and gate them at the bottom and pour at a temperature of from 1950 to 2000 degrees Fahr. The metal was melted in 1 No. 100 crucible in a coke-fired pit furnace that requires about 2½ hours for melting. The bath of metal is kept covered at all times with granulated charcoal. The casting is very spongy, the holes in some cases perforating the castings, with the entire surface more or less permeated with gas.

You forgot to mention whether or not any deoxidizer is used. Since, in the case of 88-10-2 alloy it always is advisable we suggest the addition of two ounces per hundred pounds of alloy, of phosphor copper having a 15 per cent phosphorus content. Add it to the first pool of melted metal that trickles into the bottom of the crucible.

That addition will not prevent the holes coming in the bushings, but it will prevent the characteristic oxidized appearance of the metal, visible after it is turned off particularly by reflected light. Outside of that the metal is good and no doubt it was melted correctly. The melting time of the furnace is about correct for a No. 100 pot, in a natural draft coke-fired furnace.

Gas is the cause of the holes because that is the only thing that can make holes such as those found in the casting. The gas comes from the core. It blows through into the mold, rises to the top and no doubt the most of it does get away through the sprue and the joints of the mold, but enough of it is trapped to give a heavy loss from porosity.

The cure lies in making the core. Use as much sharp sand as possible. If the cores are made in halves and pasted together, use all sharp sand, and as little binder as possible. As you pour the bushings upright the bottom vent can be closed, against the possibility of metal entering but the top vents must be open. They must be big, a hole an inch in diameter being none too big. The top core print must fit the core, so the metal is unable to run over it and get into the vent.

The pouring temperature is too low and should be kept above 2000 degrees. The proper pouring temperature for 88-10-2 is around 2100 degrees Fahr., 2050 degrees being low, but suitable for heavy castings.

BILL

By Pat Dwyer

Deplores Reckless Use of Tie Bars

I HAD a letter from an old friend of mine in the East the other day" I said to Bill as we sat on the veranda and watched the last surviving leaves fall from the trees.

Bill said "Yeah?" in a mildly inquiring manner. Apparently his interest in me, my correspondence and my friends in the East was hovering in the vicinity of the zero point—take your choice, Fahrenheit or Centigrade.

"Yeah" I repeated "and among other items of more or less interest, he touched upon your habit of commenting on points that arise in foundry theory and practice. He seems to think that you dwell over much on what everyone knows and that you should devote more time to attacking certain unworthy traditions that persistently cling to the skirts of the foundry industry."

"Oh, yeah?" The temperature suddenly jumped.

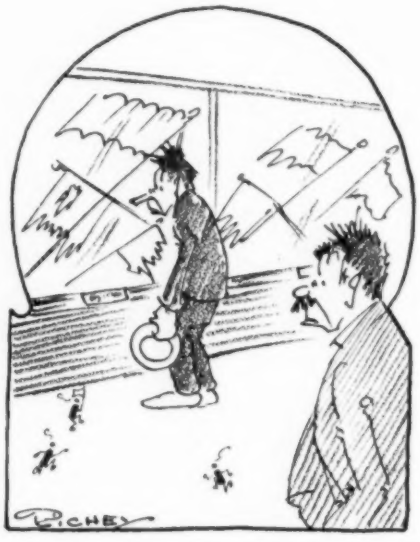
"This friend of yours" Bill said "probably moves in a restricted and highly rarefied atmosphere where everyone knows everything and nothing whatsoever is hidden from them. However, I have not yet reached that stage and I am glad to say I have a great many friends who have not yet attained that eminence. When they write to me about something that's bothering them—it may be old stuff to some people but it is new to them—I write them civily and at as great length as the occasion seems to warrant.

"Apparently they are in need of the information or they would not take the trustly old pen in hand. Apparently also if one man expresses desire for information on a certain subject, it is reasonable to infer that other men may be in the same boat. Old stuff to one man may be a distinct revelation to another. The absorption of information is a slow and gradual process. Up to the present I have heard of no general movement to abolish the primary grades in the schools on the plea that the alphabet and the three *Rs* are old stuff.

"Have you ever visited the capitol in Hartford, Conn?"

"Well" I cautiously admitted "I have been in Hartford many times and I am familiar with the appearance of the capitol with its gilded dome, I have driven or walked through the park which surrounds the Capitol building, but I never have been inside the building. If that be treason, my fine fellow, make the most of it. However, I fail to see any connection between these two widely separated subjects. Why introduce the Capitol into a discussion on school days?"

"Well" said Bill "I'll tell you. I rambled into the Hartford capitol one day this past summer and saw a copy of a poem that played the chimes on



Nothing but Flags—Tattered and Torn, They're Now At Rest

my emotions to an extent that I would not have believed possible. The original was written shortly after the close of the Civil war, but strange as it may seem I never had seen a copy. Hundreds of thousands of people probably have read the poem and to each one of them it probably is old stuff. I saw it for the first time a few months ago and it aroused in me that most poignant form of ecstasy, the kind that is akin to pain, where the throat constricts, the stinging tears creep into the eyes and you are glad no person is present to note your condition or to suggest wearily that there are other sights still to be seen.

"The walls of one lofty hall are lined with glass cases containing the returned battle flags of every Connecticut regiment in the long roll that extends back to the Revolution. Furled or partly furled, they droop there silently on their staffs, some with the fabric as clean and the colors as brilliant as on the day they first floated proudly to the breeze. Others, faded and dingy, battle scarred and shot to ribbons, scorched in places and powder stained. An ominously darker stain here and there causes the mind of the beholder to jump involuntarily through time and space to the center of a stricken field, to a youthful standard bearer stark and cold with his face to the sky, with the staff still held in a death grip, and to a flag with crimson stains and blotches distilled from the most precious of all materials, the heart's blood of a hero.

"A copy of the poem *The Returned Battle Flags* by Moses Owen appears on a small card about 5 x 8 inches set up in one of the cases. Listen:

Nothing but flags—but simple flags, tattered and torn and hanging in rags, and we walk beneath them with careless tread, nor think of the hosts of the mighty dead that have marched beneath them in days gone by with a burning heart and a kindling eye. And have bathed their folds with their young life's tide and dying blessed them, and blossoming—died.

Nothing but flags—yet methinks at night they tell each other their tales of fright. And dim spectres come and their thin arms twine round each standard torn—as they stand in line. As the word is given they charge—they form! And the dim hall rings with the battle storm. And once again through the smoke and strife, these colors lead to a nation's life.

Nothing but flags—but they're bathed in tears. They tell of triumps—of hopes—of fears; of a mother's prayer—of a boy away—of a serpent crushed—of a coming day. Silent they speak—and the tear will start, as we stand beneath them with throbbing heart. And think of those who are ne'er forgot. Their flags came home—Why came they not?

Nothing but flags—but we hold our breath, and gaze with awe at these types of death. Nothing but flags—yet the thought will come, the heart must pray though the lips be dumb. They are sacred—pure—and we can see no stain on those dear loved flags that came home again. Baptized in blood—our purest—best—tattered and torn they're now at rest.

"There y'are" Bill said "Did you ever see or hear of a neater job than that? The fact that it was written before you were born does not detract in the least from its value. It touches on some of the fundamentals of human existence, some of the things that never have changed and that probably never will change so long as we are what we are. Many things in the foundry industry may

be listed in the same category. They deal with basic principles and basic principles must be explained to each rising generation. Did your correspondence particularize or pick out any specific instance to illustrate his claim?"

"Yes" I said "He did. He is that kind of a fellow. Ready and willing at all times to debate any subject. In fact when necessary he will supply the body—your pardon, I was thinking of another lad—he will supply the subject for the debate and then will take either side, just to be obliging. I have his letter here. Just listen to this section referring to certain unworthy traditions persistent in the castings industry, particularly steel castings.

In sleuthing this matter of distortion of castings and the archaic attempts to secure proper dimensions of the casting by the use of tie bars, it is only necessary to ponder the matter a short time in order to arrive at the conclusion that the distortion of most castings is not due to abnormal behavior of the steel in cooling from solidification temperature, but is entirely due to mold or core resistance.

Take the case of a semiannular casting with a tie bar imposed across the base in the usual manner. Steel castings of such a type either tear at the tie bar junction with the casting or with favorable mold conditions, will produce a tie bar slightly curved.

Recently I had occasion to examine a number of large cast iron troughs of a *U* section which had tie bars imposed at each end to preserve the desired dimensions. Some of these castings had to be repaired where the tie bars had cracked at their junction with the casting—actually pulled a piece out of the casting—while others were not cracked but still were over the desired dimension at the top or open side of the *U*. By constructing the cope part of the mold properly, minimum resistance was offered to the normal contraction of the castings and correct dimensions were secured on the second attempt.

No tie bar is competent to overcome more than a small amount of mold resistance. Obviously then the real attack upon the problem must take the lines of providing for the relieving so that as the stress of the contracting casting is imposed, the mold will collapse and offer but little resistance to the casting.

I have found that the best way to secure this result is to use relieving blocks. These blocks are left in position in the mold until the casting is poured. After a suitable interval of time, they are withdrawn and thus the casting is permitted to contract normally. By the use of relieving blocks it is easily possible to achieve the desired result in most cases. Even in cases where the rottenest core would not function properly or where digging out the mold after pouring proved inadequate.

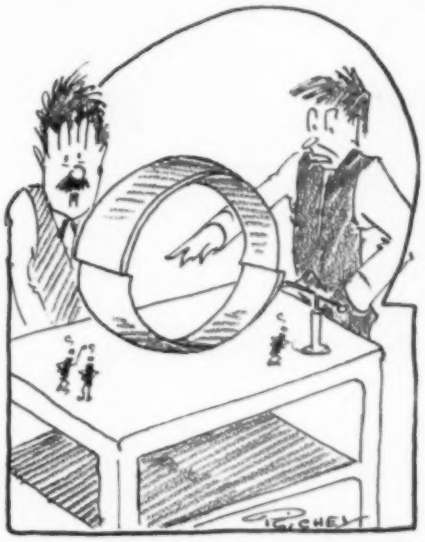
"Well" Bill said "he will not have much trouble convincing me. By the most curious coincidence I happen to hold practically similar views on the subject. Forty tie bars will not hold a casting in shape unless the mold or core yields so that the casting can contract. However, as with the majority of rules, exceptions creep in now and again.

"For example, it is conceivable to imagine a case where the mold or core may yield to a considerable extent and yet not *quite* enough. In an instance of that kind a tie bar may be just the necessary safety factor to spell the difference between a good casting and a piece of scrap.

"On half wheels or other semicircular castings, particularly those of large dimension, tie bars across the diameter are required to hold the casting to the required shape. Practical experience has shown that a casting of that shape has a tendency to spread at the ends, to open up after the manner of a bow when the tension is relaxed.

"Any person who ever has had to cast half wheels in individual molds and then assemble them afterward, will remember the almost practical impossibility of securing two halves that matched exactly and formed a true circle. The depth of the cut required to true them up in the vicinity of the joint greatly exceeded that at a point on the perimeter midway from the joint in each half wheel casting.

"Of course the proper and workmanlike way to cast wheels designed to be assembled in halves is to cast the complete wheel as a unit with splitting plates or cores at those points in the rim and hub of the mold where

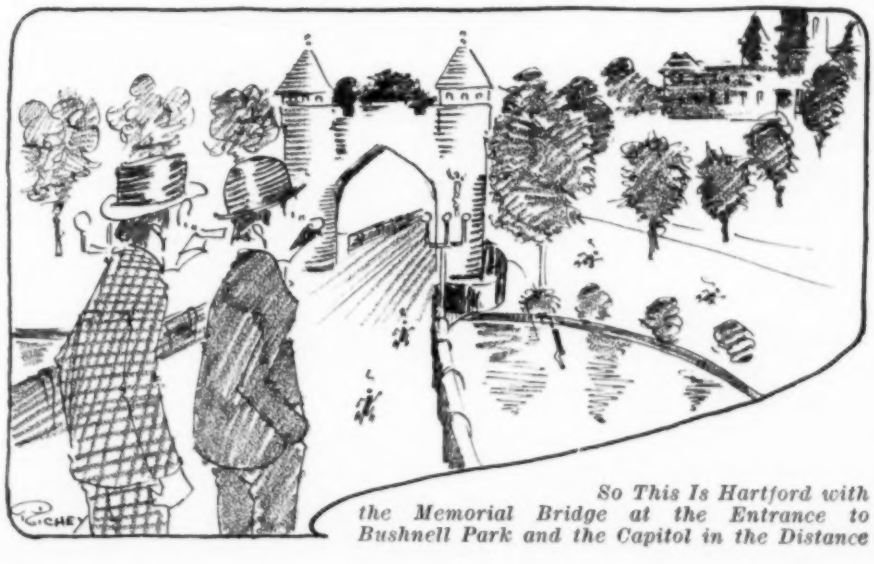


Boy, Page Mr. Euclid! Something Wrong with the Radii!

partings are desired. Sufficient metal is left at these points to insure a one-piece casting, a casting that will contract uniformly. The metal left at these parting areas is sufficiently strong to hold the parts together until after the thickness allowed for machining has been removed. It is then easily broken. The parts of the wheel are separated for any necessary manipulation with the full assurance that since the wheel was machined as a unit, the parts will fit into place when again reassembled.

"However, as I said in the first place, I am in full accord with your correspondent in his condemnation of tie rods in the majority of instances where they are employed as a kind of a forlorn hope to prevent something that could be prevented more easily by proper manipulation of the mold or core. The practice of ramming relieving blocks in various parts of certain molds and then removing them at the proper time, is practiced to a considerable extent, particularly in specialty foundries, or in foundries devoted to the production of definite lines of castings. It could be adopted more widely—and probably will be adopted eventually—among practically all foundrymen interested in the production of steel castings.

"In some instances, adoption of the practice may entail slightly added expense and reduction in output of molds per man per day. In cases of that kind it is a great consolation to the foundryman to remember that the revenue of the foundry is derived not from the number of molds upon the floor, but upon the number of castings delivered to the customer."



So This Is Hartford with the Memorial Bridge at the Entrance to Bushnell Park and the Capitol in the Distance

The FOUNDRY Family Photograph Album

Upper Left

R. J. McSHERRY
Studebaker Corp.,
South Bend, Ind.

Upper Right

G. E. SCOTT
American Steel
Foundries
New York

Lower Left

O. D. CONOVER
Foundry Equipment
Co.,
Cleveland

Lower Right

F. J. McGRAIL
Struthers-Wells-
Titusville Corp.,
Titusville, Pa.

In Honolulu They Say "Let George Do It"

POPULAR fancy pictures Hawaii as a cute little island somewhere in the South Seas, peopled principally by a race of beautiful brown maidens scantily attired in a few blossom wreaths, who alternate their waking hours between daring exhibitions of surf riding and playing soulful and catching melodies on the ukelele under the witching spell of the tropical moon. A coral beach, pure and white as Arctic snow encircles the translucent, sapphire waters of a calm lagoon in which the feathery fronds of the palms and cocoanut trees are reflected with photographic intensity.

As a plain matter of fact there is about as much romance connected with living conditions in the group of eight islands comprising the territory of Hawaii as there is in Hartford, Conn., or Hannibal, Mo. The reciprocity treaty concluded with the United States in 1876 led to an enormous development of the sugar export trade and also stimulated the production of molasses, wool, tallow, bananas and pineapples—the original, non-explosive variety.

The wheels of industry hummed louder and moved a little faster with each succeeding year. Some person had to make these wheels and keep them running, wheels for agriculture, wheels for transportation by land and sea, wheels for municipal service, wheels for every activity of a great and prosperous community self supporting and trading with continents to East, West, North and South—in a word, wheels within wheels.

A certain amount of special machinery, wheels, doodads, gadgets, hickeys, and one thing and another, still is imported, but for many years most of the metal requirements have been taken care of, as you might say, right on the premises.

When a sugar man needs anything from a new gear to a complete new mill, when a shipowner needs anything from the propeller at the stern to the anchor at the bow, when any person needs anything he says to himself, "I guess I'll get George to do that little job for me." He puts the proposition up to George, and bright and early on the following Friday or Saturday morning George delivers the goods all neatly packed and marked C.O.D.

Who is George? You don't mean to tell me—? Say, ya mus' be kon-siderable of a stranger aroun' these yere parts if ya ain't never hear'n tell of George C. Kline, works superintendent Kakaako plant of the Honolulu Iron Works Co., Honolulu, T. H. He has superintended some of the largest machine jobs ever attempted in the Territory of Hawaii. In 1927 he cast and fitted a 17-foot 6-inch bronze propeller on the British steamer SHEAF MAID. It is claimed that this 4-blade wheel weighing 21,160 pounds is the largest bronze propeller ever cast in the Pacific coast area.

He directed the conversion of the light house tender KUKUI from a coal to an oil burner. Refitted the dredge TURBINE with a cutter head when it was broken while dredging at Pearl Harbor. He gets out a couple of sugar mills per year besides the usual run of emergency, special and regular jobs that turn up.

George was born in Noblesville, Ind., Nov. 28, 1882 and a few years later commenced his mercantile and mechanical career by peddling papers and repairing bicycles as a side line while going through high school. After serving a four-year apprenticeship in the foundry of the Noblesville Foundry & Machine Co., he worked in several plants as a journeyman molder and then organized the Kline & Macy Foundry Co. He was extremely disappointed to see the new firm snuffed out of existence in the cruel year 1914, a year that marked the end of many a promising young enterprise—and of some that were not so young.

Casting about for a new field—as far as possible from Indiana—George decided that Hawaii presented attractions. His first job was that of foundry foreman for Catton, Neill & Co. In 1917 he joined the staff of the Kakaako plant and four years later was promoted to the position of works manager. Kakaako is the name of a section of Honolulu. It is a four-syllable word pronounced Kah-kah-ah-ko, practically the same word you cough up for the doctor when he hits you on the chest, tells you to open your mouth and say, "Ah!"

Many years ago George left the *Malinhini* (newcomer) class and became a full fledged *Kamaaina*. Each time he and his wife visit the mainland, they throw a *lei* (wreath) over board when passing Diamond Head to insure their return to their adopted home. George was one of the first to own an automobile in the islands and each year he claims—and gets—the same license number, 92.

He has a special weakness for thick broiled steaks, home fried potatoes and apple pie. His particular aversion is bread sliced so thin that the butter gets on his fingers.

Equipment Sales Up

Index of gross orders for foundry equipment during September was 31.9 according to a report of the Foundry Equipment Manufacturers' association. This represents a substantial gain over the index for the previous month.

Pratt & Whitney Co., machine tool manufacturer, a wholly-owned subsidiary of Niles-Bement-Pond Co., has bought the business and assets of the Keller Mechanical Engineering Corp., Brooklyn, N. Y., manufacturer of die sinking machinery and electrical equipment for machine tool control. Operations will be transferred to Hartford, Conn., and consolidated with the plant of the Pratt & Whitney Co.

DAN M. AVEY
Editor

The Shakeout

FRANK G. STEINEBACH
Managing Editor

PAT DWYER
Engineering Editor

EDWIN BREMER
Metallurgical Editor

CHARLES VICKERS
Nonferrous Editor

NORMAN F. HINDLE
Assistant Editor

¶When Uncle Sam Steps In

THE policy of firm bidding, defined as "the submission of a price accurately determined with reference to cost, to remain unchanged unless a change in buyer's specifications warrants a different quotation," has received consideration during the past few years by many different groups closely affiliated with various individual industries Originating with the sellers, it has attracted attention from both the buying and selling groups, and at the same time has gained recognition from the government

FOLLOWING a trade practice conference with the fabricators and distributors of reinforcing steel, the Federal Trade commission placed it's stamp of approval on the single bid rule, and thereby gave industry its moral backing in the practice which permits agreements to abide by a one price policy between companies of an industry. But later, in a hearing of the fertilizer and gypsum industries, the commission went much farther and defined as an illegal transaction the sale of a product at a loss. In other words the commission positively forbids in competition the sale of goods without profit, where the intent is to stifle competition or to destroy a competitor.

JUST how long it will be before the government assumes the necessary authority to completely enforce this rule is unknown. Before that time comes, industry in general will find it advantageous to take the initiative on the proposition. The practice of firm bidding offers a step toward the goal of no business without a fair profit. While its originators do not claim that the firm bidding principle is perfect in its application, general adherence will scrap practices in a great measure responsible for the unprofitable selling price of many of industry's products today.

¶What Are You Doing About It?

A MANAGER of a large eastern foundry reports that his organization is realizing on these slack times to put the plant in order. Foremen, subforemen, molders, patternmakers, metallurgists and laborers alike are being given part time work, sufficient to maintain themselves. The foundry production does not warrant this employment. Accordingly, a clean-up, paint-up program has been inaugurated. Every piece of equipment is being revamped and needed replacements made. The interior of the foundry, in every department has been given a coating of metallic paint. This work, still going forward, is being handled at low cost to the company and innovations in handling, rearrangement of mechanical units and other changes which would be impossible in busy times, can be made without disturbance. Furthermore, the men appreciate the opportunity to work.

MANUFACTURERS of foundry equipment, in many instances, are working on new designs. Modifications and improvements are the order of the day and some entirely new types of foundry machinery await only a pickup in business for their formal introduction to the industry. Recurrent cycles of depression always are periods of gestation for new ideas. Inventive genius is stimulated by adversity. The present is no exception. Those firms which maintain their faith in the future, and utilize the imposed leisure of slack business to improve their plant facilities, that study to develop new products will come out of this era with new assets and take the climbing curve of returning prosperity with increased acceleration.

¶Economic Life Changes

CHANGES that have taken place in the economic life of the United States during the 20 years from 1910 to 1930 are revealed in an anlysis recently completed by the National Industrial Conference Board, Inc., New York. Taking industry as a whole, including agricultural workers, it is estimated that there was an increase of 30.4 per cent in the total number of gainful workers as compared with a 33.5 per cent increase in population. Division of all industry into general groups indicates a wide divergence in the rate of increase, and two major divisions show a decrease. Agriculture lost 10.4 per cent, and forestry and fishing fell off 28.9 per cent.

OF SPECIAL interest are those industries in which the advance in numbers employed was more than five times the average advance. The automobile factories stand at the top of the list with an increase of 505 per cent during the two decades. Allied with them are the rubber factories which in 1930 employed 186 per cent more workers than in 1910. Remarkable development of the electrical and chemical industries in the past 20 years is indicated by increases of 325 and 408 per cent respectively for 1930.

Comings and Goings of Foundrymen

Men of the Industry, Whose Activities Are Making Foundry History

S. T. McCALL, former vice president of American Manganese Steel Co., Chicago, has been made vice president in charge of the finance department of the American Brake Shoe & Foundry Co., Chicago. His headquarters will be at the New York office of the company at 230 Park avenue.

E. S. Judkins, for several years purchasing agent for the Ashton Valve Co., Cambridge, Mass., has been transferred to the sales department of the same company.

Richard L. Cawood, president, Patterson Foundry & Machine Co., East Liverpool, O., has been elected president of the Potters Bank & Trust Co., East Liverpool.

W. A. Jackson has retired as general purchasing agent for the Walworth Co. after 48 years service. He will live on his farm near Laconia, N. H. The office of general purchasing agent has been abolished by the Walworth company.

Harry L. Erlicher, who entered the employ of the General Electric Co., Schenectady, N. Y., as an office boy in the purchasing department, has been appointed purchasing agent, succeding **L. G. Banker,** who retired Oct. 1 after completing 43 years continuous service with the company.

W. S. Werner, vice president, Kelley-Koett Mfg. Co., Inc., Covington, Ky., gave an illustrated talk before the October meeting of the Detroit Foundrymen's association on Thursday, Oct. 15, at the Fort Shelby hotel, Detroit. His subject was "Use of the X-Ray in Producing and Selling Castings."

William J. Johnson, formerly in charge of sales in the Pittsburgh district of the National-Erie Co., Erie, Pa., recently was elected president, succeeding **A. Hunter Willis. B. L. Weaver** continues as vice president and treasurer and **Henry E. Scott** was re-elected secretary and assistant treasurer.

H. Foster Bain has resigned as secretary of the American Institute of Mining and Metallurgical Engineers, effective Nov. 1, to become affiliated with the Copper and Brass Research association, New York. **A. B. Parsons,** assistant secretary, will succeed Dr. Bain for the duration of the latter's term, which expires Feb. 15, 1932.

Otis Beers has been appointed works manager, C. B. Conn Ltd., Elkhart, Ind., and **Philip Getzen** has been appointed general superintendent. Mr. Beers formerly was works manager, Buescher Band Instrument Co., Elkhart, which recently was acquired by the Conn company. Mr. Beers succeeds A. E. Virgil, formerly works manager, and Mr. Getzen, succeeds Sherman Woodward.

S. T. McCall

Institute Builds On Local Plan

(Concluded from Page 45)

Unanimous support of the principles enunciated by the chamber of commerce of the United States, Gerard Swope and Owen D. Young was voiced in a resolution introduced by John L. Carter, Newark, and referred to the board of directors for action. In effect, the institute believes that certain changes in viewpoint and governmental attitude toward business are necessary both in correcting present industrial conditions and looking to future advancement. The institute affirms the principle that action can and should be obtained through industry and that the proper agency for developing group action is the trade association. It further holds that modifications are necessary in existing laws to enable industry to protect itself and to further the revival of normal business.

The resolution endorses the plans outlined by which every industry will provide its own machinery for stabilization by measures not dictated by the government, but supported by the proper government agencies. The establishment of a national economic planning commission is urged to investigate primarily the means by which trade associations may be assisted and to aid them in attaining their objectives without jeopardizing public interests. Further such a board is asked to collect full statistical data which will show the true relation between existing capacity and normal demand in the major industries.

The nominating committee presented the names of the following for election as directors for three-year terms: A. E. Hageboeck, Frank Foundries Corp., Moline, Ill.; J. L. Carter, Sacks-Barlow Foundries, Inc., Newark, N. J.; G. W. Blakesley, Security Stove & Mfg. Co., Kansas City, Mo.; H. B. Hanley, American Laundry Machinery Co., Rochester, N. Y.; R. R. Monroe, Des Moines Foundry & Machine Co., Des Moines, Iowa; and E. B. Sherwin, Chicago Hardware & Foundry Co., North Chicago, Ill. These directors were elected.

At the meeting of the new board of directors, the following officers were elected: A. E. Hageboeck, president; J. L. Carter, vice president; J. H. Bruce, Bowler Foundry Co., Cleveland, vice president; and R. D. Phelps, Francis & Nygren Foundry Co., Chicago, treasurer.

The fourth annual dinner was held Friday night at which Don McDaniel, Decatur Casting Co., Decatur, Ind., presented trophies to the winners of the afternoon tournament. The closing resume covering features of the convention was given by Dan M. Avey, THE FOUNDRY, Cleveland.

Win Safety Citation

A number of industrial concerns in the Chicago district were cited for establishing the lowest accident frequency rate in their particular groups for the six months ended June 30, last, at the annual autumn dinner of the Chicago Safety council on Sept. 23. Thirty-seven firms received a safety plaque for their records. In the inter-plant contest, these concerns were among those winning awards: Pettibone-Mulliken Co.; Western Electric Co.; Pullman Car & Mfg. Corp., West Pullman, Ill., works; and Whiting Corp.

Orders for bath tubs in August totaled 33,601 units compared with 46,704 in July and 48,449 in August, 1930, according to the bureau of the census. Orders were received for 40,707 sinks against 51,341 in July.

Test Bar Committee To Extend Scope

A meeting of the International committee on testing cast iron was held in Milan on Sept. 16, with Professor Portevin, president of the committee, in the chair. In his opening address he made the following suggestions: (1) Include Germany in the International committee to make the group more representative and permit the committee to have advantage of investigations being carried on by German scientists; (2) Extend the scope of the committee to all tests on cast iron and malleable iron; (3) That while it is in no way the intention of the committee to make binding resolutions, it can make recommendations on points that are agreed upon by the representatives of the various countries sitting on the committee. The speaker further suggested that in each country the national committee dealing with the subject of cast iron testing should be prepared to give all the information they have been able to collect and make it available to the committees of the other countries. This could be put into practice by sending all papers and communications to the chairman of the International committee, or its secretary, together with a summary of the various papers, etc., and each year a bibliography would be established and made available to members of the national committees of the various countries.

Such data would prevent duplication of effort, or enable checking of the various results.

A discussion followed this address, a few points on which all present were in agreement were brought to light, and the suggestions offered by Professor Portevin were accepted by all present. A unanimous vote of thanks to the chairman was proposed by W. Jolley, representing Great Britain, supported by J. G. Pearce, John Cameron and J. M. Primrose, and Professor Portevin was unanimously re-elected chairman of the International committee for the ensuing year.

A Correction

In the article on page 60 of THE FOUNDRY for Oct. 1, credit for the development of the principle of firm bidding was given in error to the National Machine Tool Builders association. The organization which has been sponsoring this movement is the Machinery Builders Society, of which W. W. Nichols, Allis-Chalmers Mfg. Co., Milwaukee, is president. Others who have been active in furthering this business practice are W. E. Farrell, Easton Car & Construction Co., Easton, Pa., and Robert Gaylord, Ingersoll Milling Machine Co., Rockford, Ill.

DIRECTORY OF FOUNDRY ASSOCIATIONS

American Foundrymen's Association

President, E. H. Ballard, General Electric Co., West Lynn, Mass.; executive secretary-treasurer, C. E. Hoyt, 222 West Adams street, Chicago; technical secretary, R. E. Kennedy, 222 West Adams street, Chicago.

Associated Brass Founders of New England

President, George W. Thornburg, Crescent Park Brass Foundry, Waltham, Mass.; secretary, Herbert H. Klein, Pennsylvania Foundry Supply Co., 810 Congress street, Boston. Meetings the fourth Wednesday of each month at the Engineers' club, Boston.

The Buffalo Foundrymen

President, J. McArthur, Washington Iron Works; secretary, W. J. Wark, E. J. Woodison Co., 140 Chandler street. Meetings each month at club rooms, 140 Chandler street.

Central Illinois Foundrymen's Club

President, H. M. Hire, Hire Foundry Co., Peoria, Ill.; secretary, Franklin Whitehead, The Meadows Mfg. Co., Bloomington, Ill.

Chicago Foundrymen's Club

President, L. E. Gilmore, Crane Co., Chicago; secretary, Albert N. Wallin, S. Obermayer Co., 2563 West Eighteenth street. Meetings first Thursday in each month at the City club, 315 Plymouth court.

Connecticut Foundrymen's Association

President, Carl S. Neumann, Union Mfg. Co., New Britain, Conn.; secretary, Charles S. Parker, Charles Parker Co., Meriden, Conn. Meetings are on second Friday of each month in various parts of the state.

Connecticut Nonferrous Foundrymen's Association

President, C. H. Blanchard, Reading Steel Casting Co., Pratt & Cady division, Hartford, Conn.; secretary, C. D. Elliott, Wilcox, Crittenden Co. Inc., Middletown, Conn. Meetings held the second Monday of each month at place to be named. Recent meetings have been held at Hotel Garde, New Haven, Conn.

Detroit Foundrymen's Association

President, James L. Mahon, American Car & Foundry Co.; secretary, Neil I. McArthur, Great Lakes Foundry Sand Co., 2100 Penobscott building, Detroit. Meetings third Thursday in each month, except December, June, July and August at Ft. Shelby Hotel.

East Bay Foundrymen's Association

Secretary, O. R. Moller, Electric Steel Foundry Co. Inc., 1328 Second street, Berkeley, Calif.

Electric Steel Founders' Research Group

Director, R. A. Bull, Central Office, 541 Diversey Parkway, Chicago.

Gray Iron Institute

President, A. E. Hageboeck, Frank Foundries Corp., Moline, Ill.; manager, Arthur J. Tuscany, Terminal Tower building, Cleveland.

Malleable Iron Research Institute

President, R. R. Fauntleroy, Moline Malleable Iron Co., St. Charles, Ill.; secretary, Robert E. Belt, Union Trust building, Cleveland.

Metropolitan Brass Founders' Association

President, William Ember, Jefferson Brass Foundry, 62 Delevan street, Brooklyn, N. Y.; secretary, William E. Paulson, Thomas Paulson & Son Inc., 97 Second avenue, Brooklyn, N. Y. Meeting second Wednesday in each month at the Building Trades club, 2 Park avenue, New York.

New Jersey Foundrymen's Association

President, W. H. Mantz Atlas Foundry Co., Irvington, N. J.; secretary, G. W. Hannay, Barnett Foundry & Machine Co., Irvington, N. J. Meeting called by president. Scheduled meeting dates: Oct. 28, Dec. 2, Jan. 27, 1932, March 23, 1932, May 25, 1932.

New England Foundrymen's Association

President, Luther J. Anthony, Glenwood Range Co., Taunton, Mass.; secretary, Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass. Meetings held the second Wednesday of each month excepting July and August at the Engineers club, 2 Commonwealth avenue, Boston. Outings usually are held in the months mentioned.

Ohio Foundries Association Inc.

President, A. H. Kramer, Advance Foundry Co., Dayton, O.; secretary, Robert Hoierman, 418 Penton building, Cleveland.

Pacific Coast Founders Association

President, Charles J. P. Hoehn, Enterprise Foundry Co., 2902 Nineteenth street, San Francisco; manager, S. M. Truitt, 55 New Montgomery street, San Francisco.

Philadelphia Foundrymen's Association

President, J. B. Greenstreet, Olney Foundry Co., Philadelphia; secretary, Earl Sparks, 1623 Sansom street, Philadelphia. Meetings the second Wednesday of each month at the Manufacturers' club.

Pittsburgh Foundrymen's Association

President, H. F. Siefert, Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.; secretary-treasurer, William J. Brant, Wm. J. Brant, Bessemer building, Pittsburgh. Meetings on the third Monday of the month, except in July and August at Fort Pitt hotel.

Quad-City Foundrymen's Association

President, E. A. Gullberg, Union Malleable Iron Works, East Moline, Ill.; secretary-treasurer, Stanley Brah. Meetings the third Monday of each month, the meeting place being rotated between Moline, Rock Island and Davenport.

St. Louis District Foundrymen's Club

President, W. C. Raithel, Century Electric Co., St. Louis; secretary-treasurer, Leo J. Filstead, John C. Kupferle Foundry Co., St. Louis. Meetings the fourth Thursday of the month at 6:30 p. m., at the American Annex hotel, Sixth and Market streets, St. Louis.

Southern Metal Trades Association

President, John S. Schofield, J. S. Schofield's Sons Co., Macon, Ga.; secretary, W. E. Dunn Jr., Flatiron building, Atlanta, Ga.

Steel Castings Development Bureau

Research Director, George Batty, 500 Stock Exchange building, Philadelphia.

Steel Founders' Society of America

President, W. H. Worrilow, Lebanon Steel Foundry, Lebanon, Pa.; managing director, G. P. Rogers, Graybar building, New York.

Tri-City Technical Council

Chairman, C. F. Scherer, Davenport Machine & Foundry Co., Davenport, Iowa; secretary, E. C. Xander, assistant secretary, Tri-City Manufacturers association, Moline, Ill. Combined meetings held only one or two times a year on call.

Tri-State Foundrymen's Association

President, William Hoppenjans, The Star Foundry Co., 221 Main avenue, Covington, Ky.; secretary, C. C. Erhart, Chris Erhart Foundry Co., Cincinnati. Meetings the second Thursday of each month at the Cincinnati club, Eighth and Race streets.

Twin City Foundrymen's Association

President, Frederick Christensen, R. R. Howell & Co., Minneapolis; secretary-treasurer, C. E. Langdon, 3849 Lyndale avenue, south, Minneapolis. Meeting third Wednesday of each month at Athletic club.

Washington Foundrymen's Club

President, Rex L. Alexander, Olympic Steel Works, Seattle; secretary, Edward C. Gustin, 3716 Grayson street, Seattle. Meetings second and fourth Tuesdays of each month at the Elks Temple, Fourth avenue and Spring street.

Western Foundrymen's Association

President, H. T. Hornsby, Joplin, Mo.; secretary, E. L. Graham, Acme Foundry & Machine Co., Coffeyville, Kans.

Wisconsin Gray Iron Foundry Group

Secretary, W. F. Bornfleth, Cutler-Hammer Inc., Foundry Division, Milwaukee. Meetings on second Wednesday of each month at Hotel Schroeder, Milwaukee.

OBITUARY

Wendell Bert Folsom, president, Exeter Brass Works, Exeter, N. H., died recently in Wallingford, Vt., while on a motor trip. Mr. Folsom was born March 25, 1864 in Exeter. He was 68 years old and had been actively engaged in the management of the Exeter plant for 35 years. The business was founded by his father, Eben Folsom in 1865. Mr. Folsom was educated in the public schools of Exeter and later attended Bryant & Stratton Business college, Boston. Since that time he had been associated with the Exeter Brass Works. Mr. Folsom was active in many industrial enterprises.

Robert Wise, 54, president and treasurer, Buckeye Products Co., Cincinnati, died recently.

Otto Kohler, one of the organizers and president, Meadville Malleable Iron Co., Meadville, Pa., died recently.

Willis A. Slater, 54, research professor of engineering materials and director, Fritz Engineering laboratory, Lehigh university, Bethlehem, Pa., died Oct. 6.

A. C. Goldman, vice president of the Sterling Brass Co., Cleveland, died Oct. 13 at Erie, Pa., of a fractured skull received in an automobile accident. He was 53.

T. H. Maytag, 67, Maytag Co., Newton, Iowa, died recently from injuries suffered in an automobile accident near Grinnell, Iowa, Sept. 10. He had been associated with his brother, Fred L. Maytag, in the washing machine company for 32 years.

Louis Schlesinger, founder of the Bradley Washfountain Co., Milwaukee, died Oct. 11 at the age of 75 years. He was a brother of the late Ferdinand Schlesinger, a pioneer in the iron, steel and chemical industries now embraced by the Newport Co., Milwaukee.

Albert Jefferson Sayers, noted engineer with the Link-Belt Co., Chicago, died at his home, 7121 Eggleston avenue, Chicago, Oct. 11, at the age of 61. Mr. Sayers had been connected with the Link-Belt Co. for 32 years, devoting the most of that time to the problems of mechanical handling, screening and washing of coal.

Louis C. Corbus, 56, purchasing agent for the Standard Sanitary Mfg. Co., Pittsburgh, died Oct. 14. He was born in old Allegheny, Pa., and was educated in the public schools of Beaver Falls and at Geneva college. He joined the Standard company in 1907 as assistant purchasing agent and before that was in the purchasing department of the American Bridge Co. at Ambridge, Pa.

Phillip Schwenn, superintendent, H. P. Deutcher Co., Hamilton, O., died Oct. 4 at his home in Hamilton at the age of 62 years. Mr. Schwenn was born March 11, 1869 at Kitchener, Ont., but when he was six weeks of age, his parents moved to Hamilton, O., to make their home. Mr. Schwenn learned the trade of a molder and served with the Sohn, Rentschler Co. and later was foreman of the Hamilton Foundry & Machine Co., Hamilton.

James Connolly, vice president, Lovewell-Henrici Co., Chelsea, Mass., died recently following a heart attack. Mr. Connolly was born in Hull, England and came to this country when a young man. He worked in Biddeford, Maine, and in Charlestown for a short period and then formed a business connection with S. K. Lovewell and John Ashman of Boston. The latter firm absorbed the Henrici Laundry Machinery Co., and incorporated as the Lovewell-Henrici Co., approximately 40 years ago. In 1910 Mr. Connolly started a crucible steel foundry on Clark avenue, Chelsea, incorporating it under the name of the Connolly Steel Casting Co.

W. B. Folsom

W. Shives Fisher, 77, former president, Canadian Manufacturers' association, died at St. John, N. B., Oct. 15. He began his business career in St. John where in partnership with the late R. B. Emerson he established the firm of Emerson & Fisher Ltd. He later organized the Enterprise Foundry Co., Sackville, N. B., of which he became president. He had other extensive interests, being president, St. John Hardware association and a director, New Brunswick Power Co. During the war he was commissioner in charge of the Dominion Rifle Factory, Quebec, Que. and was in charge of the outfitting of the first Construction Battalion going to France.

Dr. Samuel Wesley Stratton, chairman of the corporation and former president of Massachusetts Institute of Technology, Cambridge, Mass., former director of the bureau of standards, Washington, and distinguished physicist, died Oct. 18 at his home in Back Bay, Mass. Dr. Stratton was born on a farm in Litchfield, Ill., and received his education at the University of Illinois. After a period of teaching at the University of Illinois and the University of Chicago, he interested Lyman J. Gage, secretary of the treasury, in the need for standardization and research in the American industries, and became the head of the bureau of standards when the plan for such a department was adopted by Congress. He held that post 21 years until he resigned to become president of M. I. T. in 1923.

Building Awards Gain

Construction contracts awarded in September in 37 states east of the Rocky Mountains were valued at $252,109,700, an increase of $19,003,600 compared with awards in August, according to the F. W. Dodge Corp. Compared with September, 1930, awards declined 24 per cent.

Engineers To Meet

The fifty-second annual meeting of the American Society of Mechanical Engineers will be held in New York from Nov. 30 to Dec. 4. Twenty-six technical sessions have been arranged to cover various subjects including materials handling, machine shop practice, applied mechanics, power, fuels, management, iron and steel, education and training, etc.

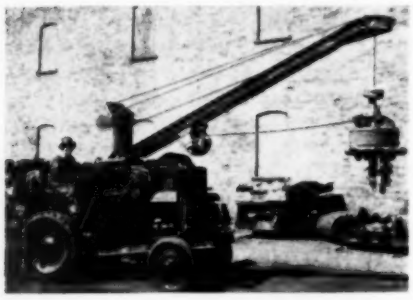
Establishes Offices

Hanna Furnace Corp. has establishe sales offices in New York, Philadelphia and Boston for the sale of foundry and malleable pig iron, silvery iron and ferrosilicon. That firm formerly was represented in the eastern territory by Rogers Brown & Crocker Bros. Inc. The New York office, 30 Church street, will be in charge of C. R. Wells, formerly with Pilling & Co. The Philadelphia office, 902 Packard building, will be in charge of C. E. Trommer, formerly with Rogers Brown & Crocker Bros. Inc. The Boston office, 514 Chamber of Commerce building, will be in charge of S. B. Burke, formerly at the Buffalo office of the Hanna Corp.

Report of a series of investigations on the deoxidation of steel with silicon are presented in technical paper No. 492 published by the bureau of mines. The authors of the bulletin are C. H. Herty Jr., G. R. Fitterer, and C. F. Christopher. Copies may be obtained from the superintendent of documents, Washington, for 15 cents.

Equip Loading Truck with Magnet

The loading truck, manufactured by Bucyrus-Erie Co., South Milwaukee, Wis., and mounted on either wheels or crawlers, now may be obtained equipped with a 20-inch magnet made by the Ohio Electric Mfg. Co., 5906



The Truck Has a Full Revolving Boom

Maurice avenue, Cleveland. This magnet equipment makes the machine a useful tool for handling scrap iron and small castings which ordinarily require considerable time for hooking. The truck requires no more space for operation than a small automobile, has a full-revolving boom and can be used as a tractor, as a crane or can lift and travel with its load. Power is supplied to the magnet by a 2 kilowatt-hour electric plant, mounted on the truck frame of the crane.

Lancastria Club Meets

Once again members of the Lancastria club met happily on the occasion of the International Foundry congress which was held in Milan and Rome, Italy, during the second half of September. The Lancastria club, formed by European foundrymen who traveled to America on the occasion of the International Foundry congress in Detroit in 1926 on the S. S. LANCASTRIA, holds its annual banquet at the principal foundry congress of the year.

This year's banquet was held in Campari's one of the leading restaurants of Milan. As on previous occasions, the dinner was imbued with cordiality and friendship, and a gaily-colored replica of the LANCASTRIA adorned the center of the table.

The dinner unfortunately was clouded by absence of the chairman of the Lancastria club, Frank Russell, Sheffield, England. His absence and that of Mrs. Russell was regretted in toasts subsequently given by H. Magdalenat and John Cameron. Carlo Vanzetti replied to the toasts and the speakers referred to the increasing bonds of friendship which unite members of the club year after year.

Many of the members was unable to attend the congress in Milan, but the dinner was attended by 17 members, many of whom were accompanied by their wives, sons or daughters. The dinner was followed by a dance. The following members were present: Mr. and Mrs. Vanzetti and their two daughters; Guido Vanzetti; Antonio Galtarossa; Gino Modigliani; Amedeo Pellicciotti; Count Franco Ratti; Agostino Rocca; H. Magdalenat and Mrs. Magdalenat, Jean Montupet and Mrs. Montupet; Leon Montupet; E. V. Ronceray, Mrs. Ronceray and Miss Ronceray; John Cameron and Mrs. Cameron; H. D. Campbell and Mrs. Campbell; W. Jolley, Mrs. Jolley and Miss Jolley; J. M. Primrose, Mrs. Primrose, and son Tom; V. Delport and Mrs. Delport.

Builds Portable Drier for Pit Molds

Young Brothers Co., Detroit, has developed and recently introduced a new portable type pit mold drier designed to provide economies in operation and a high degree of proficiency. One or more of these units are set up over the covered mold with their heat ducts so placed as to provide a definite heat flow to all exposed surfaces of the mold. The driers are then fired and allowed to function under control until the mold is dried to the extent desired.

It is claimed the heat flow from the drier is under complete control at all times, so that any desired temperature can be maintained. The heated gases from the drier are under greater than atmospheric pressure and thus can be directed wherever necessary in their flow through the mold, providing proper circulation of the heat within the mold.

The drier burns coke, gas or oil, as desired. When furnished for coke, it will operate satisfactorily on a cheap grade of fuel. In the installation shown in the accompanying illustration, the battery of driers is in use on a large roll housing containing 120,000 pounds of sand and 100,000 pounds of steel in both cope and drag. A temperature of 450 degrees Fah. is maintained throughout the entire inside of the mold for a period of from 60 to 64 hours.

Philadelphia Founders Hear Talk on Coke

The Philadelphia Foundrymen's association, held its first regular meeting since the summer adjournment, on Wednesday, Oct. 14, at the Manufacturers' club, Philadelphia. Julian Greenstreet, superintendent, Olney Foundry Co. and newly elected president of the association, presided.

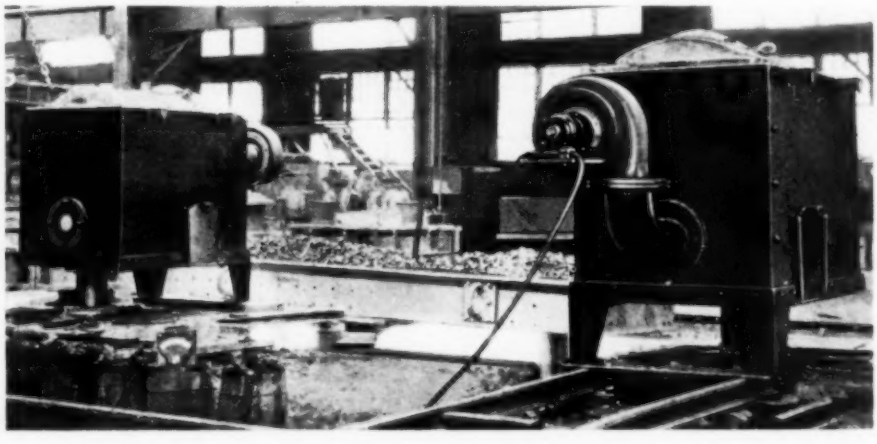
Dr. Robert B. Schaal, chief chemist, Hatboro Foundry Co., subsidiary of Roberts & Mander Stove Co., Hatboro, Pa., addressed the meeting on "Different Types of Coke in Relation to the Melting Process." He covered the different qualities of beehive and by-product coke, the relation of the size of coke to the character of the metal to be melted, the effect of moisture and blast pressure on coke, and the use of single and double row of tuyeres.

The meeting was well attended and interest in the subject was evidenced by a lengthy discussion following Dr. Schaal's address.

Production Gains

Tonnage of malleable and steel castings produced in the Philadelphia district in August was more than that reported for the previous month. Malleable production increased 2.8 per cent while the output of steel castings gained 5.2 per cent over July. Output of gray iron castings in 31 foundries during August was 12.4 per cent less than in July.

Chicago office of the American Manganese Steel Co. has been moved to Room 1414, McCormick building, 332 South Michigan avenue, the location of the parent company, American Brake Shoe & Foundry Co. E. F. Mitchell and E. R. Dougherty are sales representative in charge.



Heated Gases May Be Directed To All Exposed Surfaces of the Mold

Uses Point System to Compute Rate

(*Concluded from Page 59*)

be applied to practically any squeezer job and to about 80 per cent of the bench jobs. We have found that it is not reliable for complicated bench work, nor for any floor or large machine jobs on direct application. However, it is possible to make an application indirectly, as follows: Take a job on which a satisfactory molding price has been established and determine the total points. Divide the price by the total points to get the value of the point in cents. Determine the total points for the new floor or bench job in the usual manner and mu'tiply the total points by the value pef point to establish the new molding price.

For example, suppose we are required to set a price on a floor job weighing 20 pounds having no core and made in a 20 x 40 x 8 inch flask. The ordinary application of the point system gives $23 per 100 molds as the piece rate. Knowing that this rate is entirely too high, we check into other floor jobs which we have made before and find a somewhat similar job which has been running satisfactorily at a piece rate of $17.25 per 100 molds. We find that the total for this job is 400 points, or a value per point of $.0431. The points for the new job total 300, so the total price is 300 × $.0431, or $12.93 per 100 molds.

We have found that the value per point varies widely between floor and bench jobs, but by selecting the standards of point value from jobs which have been well established, practically any job can be rated under the point system.

In addition to establishing a definite standard for molding rates in the foundry, the point system can be used to great advantage by the sales department for estimating purposes. Any salesman who understands the rudiments of molding can estimate the flask size and rate the cores in a job closely enough to permit him to make an estimate of the molding cost of a job which will be close to the price actually paid.

Thus, he is enabled to make a casting price to the customer in many cases where, without the aid of the point system, he would be obliged to go back to the plant and confer with the foundry foreman before being able to quote prices on the job.

Some of the standards of the point system have been criticized by people who have checked them against time studies. The principal complaint made is against the allowances for setting or dropping a large number of small cores. It seems that when more than eight similar cores are set or dropped in one mold, the allowanaces of two and one points, respectively, are too high, and allowances of 1½ and ½ points are ample.

The remainder of the system appears to check closely with time-study rates. Since many foundries have no time-study facilities, the point system offers a simple, reliable method of establishing equitable molding piece rates.

Drop in the production of pig iron was less severe than in several previous months, according to STEEL. Average daily production in September was 38,821 tons, compared with 41,264 tons in August and 75,893 tons in September, 1930. The total production for the month reached 1,164,646 tons compared with 1,279,205 tons in August. Production of merchant iron is reported as 268,108 tons against 308,436 tons in August.

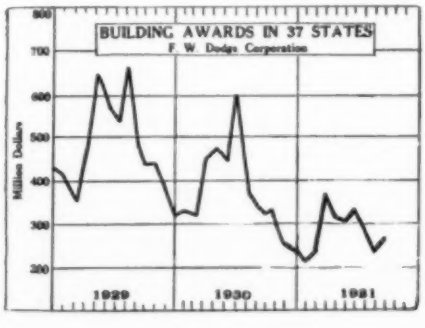
What the Foundries Are Doing

Reflecting the Activities of Gray Iron, Malleable, Steel and Brass Shops

Atlas Ansonia Co., New Haven, Conn., has purchased the Mount Carmel Mfg. Co., Mount Carmel, Conn.

Outlook for increased activity among foundries producing automotive castings in Western Michigan is promising.

Forty molders were returned to work



at the Baltimore & Ohio Railroad foundry at Newark, O., on Oct. 7.

The New York Central railroad has moved its foundry from Franklin, Pa., to Elkhart, Ind.

Erb-Joyce Foundry Co., Detroit, has installed a second electric furnace at its plant in Wyandotte, Mich.

An agreement has been reached between Doehler Die Casting Co., New York, and the Bohn Aluminum & Brass Corp., Detroit, whereby the die casting division of the latter company has been taken over by Doehler in exchange for the Doehler permanent mold department.

Foundry activity in the New York district has increased slightly, operations averaging around 35 per cent, according to recent reports.

The foundry department of the American Rolling Mill Co. resumed operations Monday, Oct. 12, after being idle for several months.

R. W. Stoker has acquired the Modesto Iron Works, Modesto, Calif., and has changed the name to the Atlas Foundry Co.

Hinrichs Foundry & Vault Light Co., Brooklyn, N. Y., has been incorporated with $100,000 capital by Barber & France, 32 Broadway, New York.

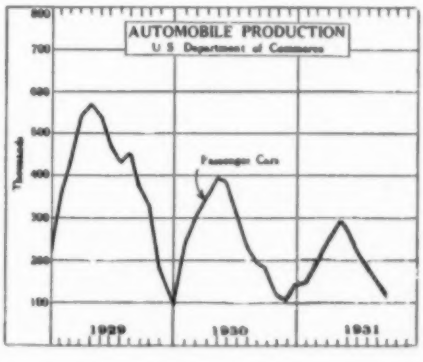
Vulcan Iron Works, 132 East Butler street, Memphis, Tenn., suffered considerable damage from fire Oct. 2. The plant will be rebuilt.

Guy Rinebolt, owner, Rinebolt Foundry Co., Huntington, Ind., has purchased the Jalco Motor Co., and plans to combine the two plants.

Remaining assets of the Knoxville Foundry & Machine Co., Knoxville, Tenn., recently were sold in court for $1350 to S. H. Robinson & Co.

Patterson Foundry & Machine Co., East Liverpool, O., has opened an office in the Rialto building, San Francisco, in charge of Edgar S. Browning as district manager.

Jobbing foundries in the St. Louis district are averaging around half time operations, while malleable plants report slight improvement in demand from the automotive industry. Several impor-



tant manufacturers of farm implements whose plants have been idle for some time, are reported to plan resuming operations on Nov. 15.

Olympic Foundry Co., Seattle, has added a light casting department for the manufacture of oil-burning parts, cast iron plumbing materials and hardware specialties.

Reports indicate that farm implement

companies in the Chicago district will resume operations in December and that at least one will start a fair operative schedule early in November.

Former plant of the U. S. Malleable Iron Co., Wauseon, O., has been leased by Thomas F. Logan, Toledo, O., who will operate a jobbing foundry. Charles Brunning, formerly of Wauseon, is associated in the new enterprise.

Barberton Foundry Co., Barberton, O., subsidiary of the Akron Standard Mold Co., Akron, Ohio, is working on a six day schedule according to Harold J. Walsh, factory manager. In September, the plant was working on seven-day week schedule. The Barberton Foundry recently suffered a $31,000 fire loss but has been completely rebuilt.

Suit has been filed in federal district court at Pittsburgh by the reorganization committee, asking a receiver for National Radiator Corp. This action, it is alleged, is taken to protect bondholders and creditors. Interested on a $10,000,000 bond issue due in 1947 was defaulted recently. National Radiator Corp. has nine plants for making steam and hot water radiators and cast iron boilers for heating purposes; two plants at Johnstown, Pa., where are also general offices; two at New Castle, Pa., and one each at Trenton, N. J., Utica and Dunkirk, N. Y., Framingham, Mass., and Chicago. It also has warehouses or offices at New York, Boston, Philadelphia, Chicago, Cleveland, Pittsburgh, Baltimore, Cincinnati and Richmond, Va. On Feb. 11, 1931, a plan and agreement to reorganize the corporation were formulated by a reorganization committee headed by Rudolph B. Flersham as chairman, he also being chairman of the executive committee of the National company. Robert S. Walters, Johnstown, Pa., executive vice president, and William G. Heiner, Pittsburgh, have been appointed receivers, and have been directed to continue the business.

United Dry Docks Inc., Staten Island, Aldrich Pump Co., Allentown, Pa., and Capitol Foundry & Machine Co., Troy, N. Y., will share in supplying 209,000 pounds of cast iron sinkers and ballast balls for special buoys to be constructed for the third lighthouse district, Staten Island, N. Y. Forty-two units weighing from 290 to 8500 pounds each will be supplied.

New Trade Publications

ARC WELDERS—Electric arc welders made by General Electric Co., Schenectady, N. Y., are described in a recent illustrated bulletin. Features of construction and operation are outlined, and engineering data are given.

V-FLAT DRIVES—Gates Rubber Co., Denver, recently issued bulletin V-39-501 describing flexible , rope, V-flat, drives. Design data are given covering sheaves, belts, power and service. Illustrations show typical applications.

ROOFING SHEETS—A folder has been prepared by Inland Steel Co., Chicago, showing a new type of roofing sheet which is provided with a triple barrier against water to resist the severest rains.

ALUMINUM PAINT—A 45-page booklet recently issued by the Aluminum Co. of America, Pittsburgh, contains data on aluminum paint, and its uses. Its advantages in a wide variety of industrial applications are pointed out, and typical uses illustrated.

RIDDLES—High grade workmanship is pointed out in foundry riddles described in a recent folder from Buffalo Wire Works Co. Inc., 316-326 Terrace, Buffalo, N. Y. The riddles are supplied in steel or brass wire from 2 to 14 mesh.

PULVERIZER—Grindle Fuel Equipment Co., Harvey, Ill., recently issued an illustrated bulletin describing a table roller pulverizer. Mechanical features are shown in a sectional illustration; materials pulverized are listed; and illustrations of typical applications are shown.

TECHICAL MODELS—Outlining the facilities of the company in producing technical models for every trade and purpose, Paul F. Hermann, Keenan building, Pittsburgh, recently has issued an illustrated bulletin. Typical examples of models made of engines, bridges, and architectural subjects are shown.

ROTARY BLOWERS—Bulletins recently issued by Roots-Connersville-Wilbraham, division of International-Stacey Corp., Connersville, Ind., illustrate and describe heavy and standard duty rotary blowers. Data tables and specifications are given and mechanical features illustrated.

ELECTRIC EQUIPMENT—A series of illustrated bulletins recently issued by General Electric Co., Schenectady, N. Y., includes the following: Industrial heating devices, induction motors, multistage centrifugal air compressors, squirrel-cage induction motors, explosion-proof induction motors, single-stage centrifugal air compressors, direct current motors, magnetic switches, electric control devices, and built-in speed reducers.

PNEUMATIC TOOLS—Cleveland Pneumatic Tool Co., Cleveland, has issued a catalog in French for use in export trade. It illustrates products of this company and its associate, the Cleveland Rock Drill Co.

SAND HANDLING—Complete sand handling, reclamation, and conditioning systems are recommended as a means for cutting steel foundry costs in a recent folder issued by the Jeffrey Mfg. Co., Columbus, O. A suggested layout is sketched and illustrations show typical applications.

TURBO BLOWERS—Allis-Chalmers Mfg. Co., Milwaukee, in a current bulletin, No. 1907, describes its line of turbo-blowers and turbo-compressors, recently purchased from the American Brown-Boveri Co. Application of this equipment to various purposes in industry is suggested.

FLEXIBLE COUPLINGS—Morse Chain Co., Ithaca, N. Y., in a recent bulletin describes its type of flexible couplings, with the aid of many illustrations, data tables and charts. Among the illustrations are several showing varied uses of the couplings in different branches of industry.

WELDING EQUIPMENT—Torchweld Equipment Co., 224 North Carpenter street, Chicago, has issued a pocket catalog of its line of equipment for use in welding and cutting operations. Numerous new items of equipment added since the previous catalog serve to supplant the original line.

ELECTROCHEMICAL PATTERNS—Product, process, and wearing qualities of electrochemical foundry patterns are outlined in a recent leaflet issued by the Pioneer Engineering & Mfg. Co., 8316 Woodward avenue, Detroit. Long life and accuracy are emphasized as money-saving factors.

GEARS AND MACHINERY—A 100-page catalog from the Earle Gear & Machinery Co., 4707 Stenton avenue, Philadelphia, lists a complete line of gears, racks, sheaves, and machine parts, typical products are illustrated and the service of the company in making all types of gears to customer's orders is pointed out.

PICKLING BASKETS—A recent folder from the Kirk & Blum Mfg. Co., 2850 Spring Grove avenue, Cincinnati, illustrates pickling baskets and crates and outlines the service of the company in supplying pickling containers to meet industrial requirements. Blower systems designed by the same company also are described briefly.

SPEED REDUCERS—A catalog recently issued by Palmer-Bee Co. Inc., Detroit, describes and illustrates a wide variety of speed reducers in herringbone, worm, and spur gear types. Engineering data are given and mechanical features of construction illustrated. Superiority in design and construction is pointed out.

ELECTRIC HEAT—Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., devotes a current catalog of its electric heating devices to their application to industrial uses. Illustrations of heating devices are supplemented by charts showing heating curves and results of various degrees of heat.

RAW MATERIAL PRICES

Oct. 21, 1931

Iron	
No. 2, foundry, Valley	$16.50 to 17.00
No. 2 Southern, Birmingham	12.00
No. 2 foundry, Chicago	17.00
No. 2 foundry, Buffalo	17.00
Basic, Valley	15.00 to 15.50
Basic, Buffalo	16.50 to 17.00
Malleable, Chicago	17.00
Malleable, Buffalo	17.50
Coke	
Connellsville Beehive coke	$3.25 to 4.50
Wise county beehive coke	4.25 to 5.00
Detroit by-product coke	8.00
Scrap	
Heavy melting steel, Valley	$9.25 to 9.75
Heavy melting steel, Pitts	10.00 to 10.50
Heavy melting steel, Chicago	7.75 to 8.25
Stove plate, Buffalo	8.25 to 8.75
Stove plate, Chicago	7.00 to 7.50
No. 1 cast, New York	7.00 to 7.50
No. 1 cast, Chicago	8.50 to 9.00
No. 1 cast, Philadelphia	11.50 to 12.50
No. 1 cast, Pittsburgh	10.00 to 10.50
No. 1 cast, Birmingham	9.00 to 10.00
Car wheels, iron, Pittsburgh	10.50 to 11.00
Car wheels, iron, Chicago	9.50 to 10.00
Railroad malleable, Chicago	8.50 to 9.00
Agricultural mal., Chicago	8.00 to 8.50
Malleable, Buffalo	10.00 to 10.50
Nonferrous Metals	
	Cents per pound
Casting copper, refinery	6.75 to 7.00
Straits tin	23.00
Aluminum, No. 12, producers	22.00
Aluminum, No. 12 remelt	8.50 to 9.50
Lead, New York	3.75
Antimony, New York	6.65
Nickel, electro	35.00
Zinc, East St. Louis, Ill.	3.30